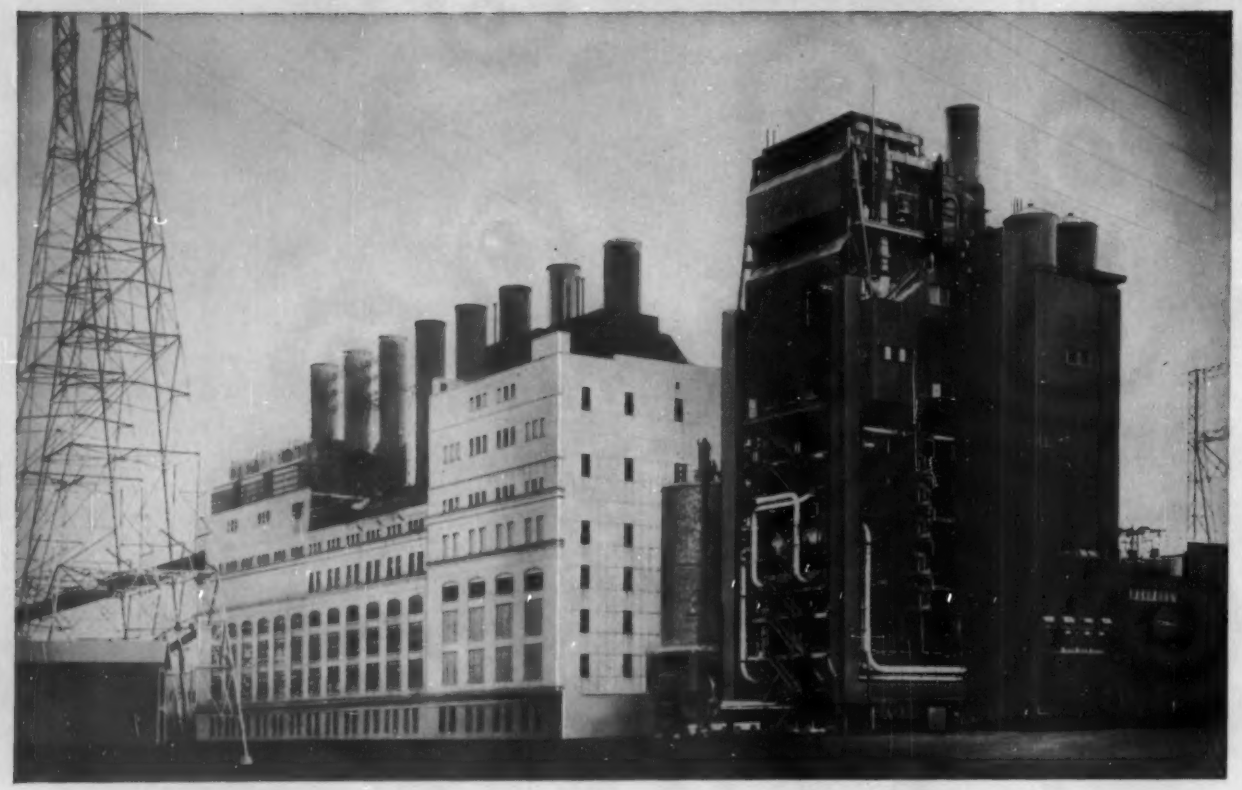
SEPTEMBER 1955

Power Engineering

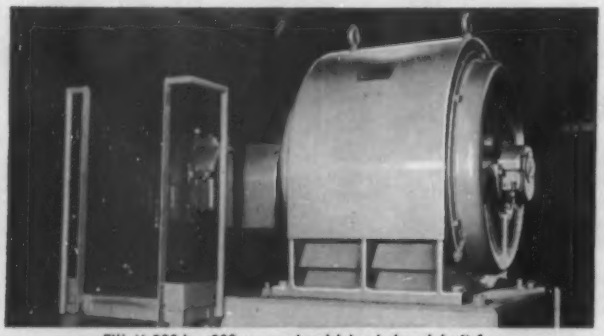
Gas-Fired Unit Heaters or Steam—Which Is Better? 57
Choosing, Installing, Maintaining Valves 58
Good Old Reciprocating Steam Pump . . . Still Young at Heart 60
Great Northern's New 1250-psi Power Plant Serves Expanded Paper Mill 62
So—You're Going to Overhaul Your Turbine! VI. Metallizing Turbine Shaft 65
Vinyl Paint Hard to Handle? . . . Spray It Hot 70
CTI Research Yields Cooling Tower Performance Standards 73
Sewage and Waste Treatment Increases Nation's Need for Kilowatts 74
D E Co.'s Work Simplification Program 76
New Breaker Uses Current-Limiting Fuses 79
C L & P Reports Experience With Hydrazine in Reheat Cycle 80
What Happened to the Humphrey Internal Combustion Pump? 85
POWER ENGINEERING'S News Reel 86
Graphical Boiler Heat Balance—Loss Due to Dry Flue Gases 88
Geneva Report:—Boiling Water Reactor Simple, Safe, Promising 90
Save Money With Color 92
Water-Cooled Engine Omits Fan, Pump and Radiator 93
Chicago Power Show Will Feature New Designs 94

REGULAR DEPARTMENTS

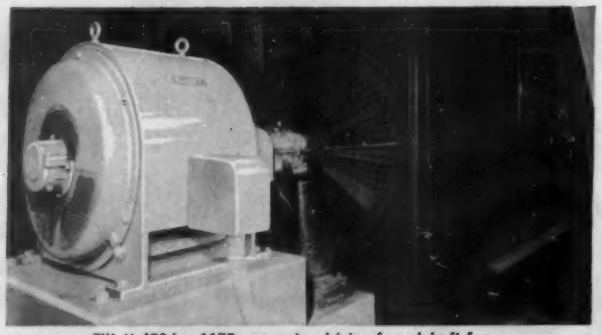
Engineer's Preview 3
Letters to the Editor 4
Here's What They Tell Us 6
Helpful Bulletins 27
Equipment News 42
Power Engineering Handbook 96
Obituaries 112
Engineering Books 114
Catalog Library 121
Readers' Service Post Cards 121
Advertisers' Index 136
Circulation of This Issue 36,245



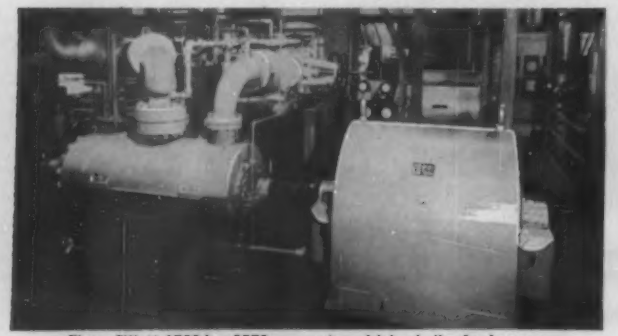
ELLIOTT equipment on the job



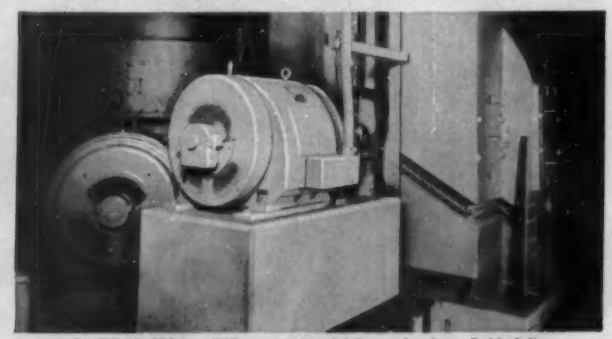
Elliott 800-hp, 890-rpm motor driving induced-draft fan.



Elliott 450-hp, 1175-rpm motor driving forced-draft fan.

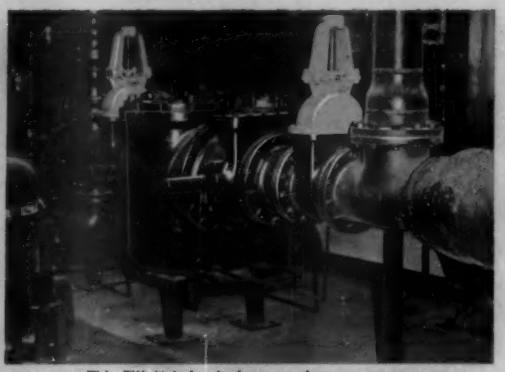


Three Elliott 1750-hp, 3570-rpm motors driving boiler-feed pumps.



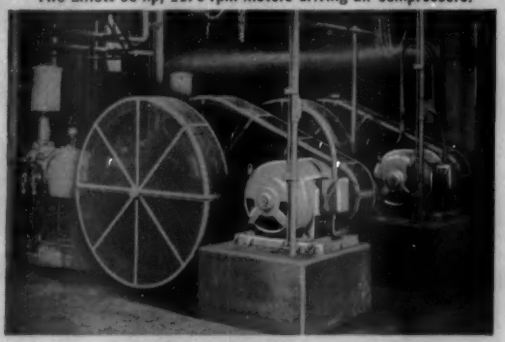
An Elliott 200-hp, 590-rpm motor driving pulverizer. Behind it is an Elliott 250-hp, 177-rpm motor driving primary air fan.

Elliott deaerating feedwater heater, rated 1,000,000 lb per hr, is installed outdoors.



This Elliott twin strainer, serving emergency fire water system, is also installed outdoors.

Two Elliott 50-hp, 1170-rpm motors driving air compressors.



Springdale Station expands with new "outdoor" unit

throughout modern addition!

● West Penn Power Company's Springdale Station has been steadily growing since it first went on the line in 1920. Since that time, new generating units have been added four times and the station has now been brought up to 450,000 kw to serve the growing Western Pennsylvania area. This latest addition—Unit Number Eight—has a capability of 140,000 kw and is an independent unit of semi-outdoor type construction. As is the case with the older units, Elliott equipment is found throughout the new addition. The deaerating heater, evaporator preheaters, twin strainers, and motors driving auxiliaries such as boiler-feed pumps, forced- and induced-draft fans, pulverizers and compressors all bear the Elliott nameplate.

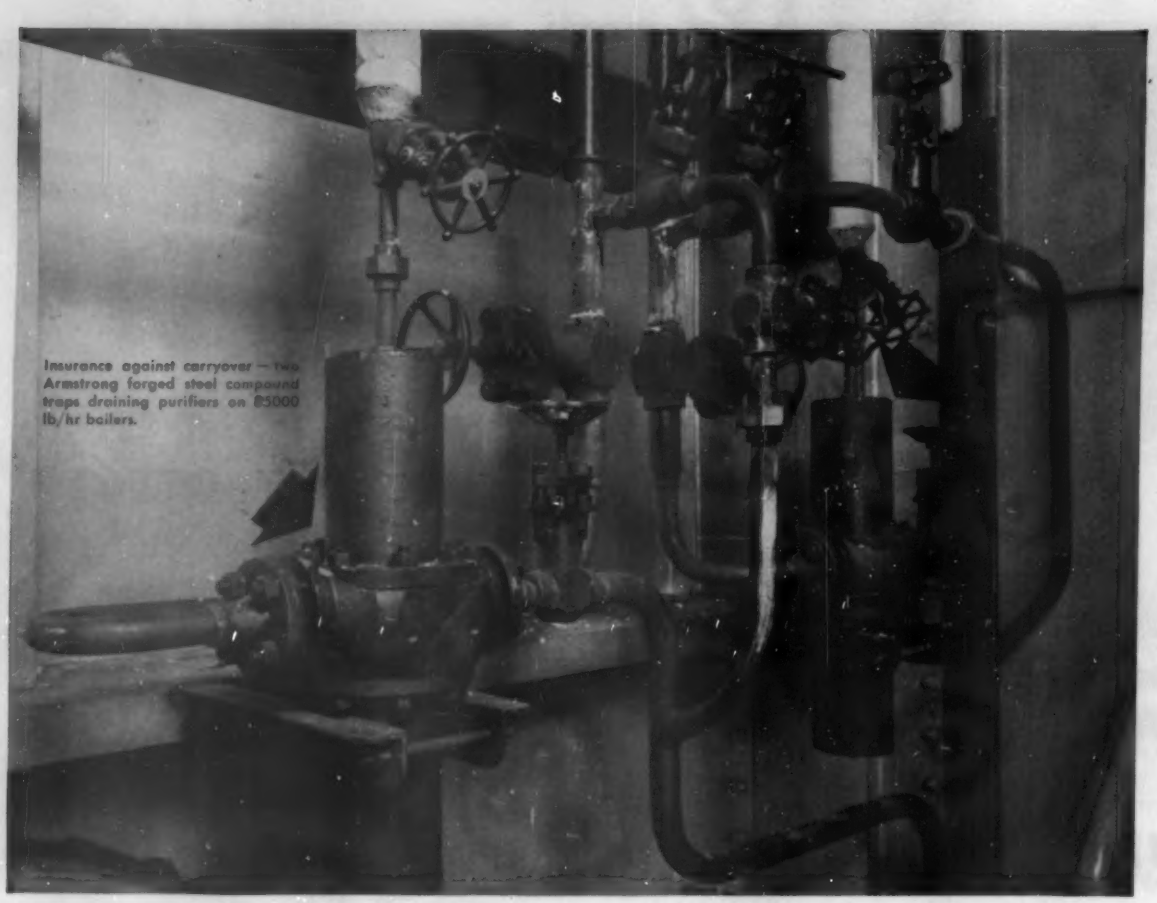
Elliott has been building power equipment for more than half a century. If expansion or modernization is in your picture today or tomorrow, it will pay you to investigate this equipment. Check with your Elliott District Office or write Elliott Company, Jeannette, Pa.

ELLIOTT Company

QS-1

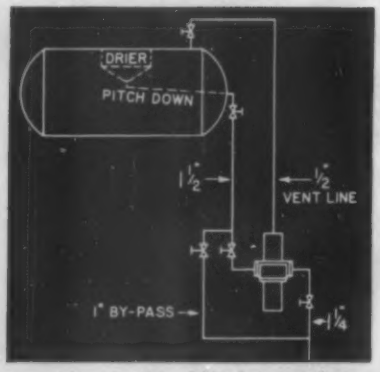
TURBINE-GENERATORS TURBINES MOTORS GENERATORS DEAERATING HEATERS EJECTORS CONDENSERS COMPRESSORS TURBOCHARGERS TUBE CLEANERS STRAINERS

For more data circle 501 on Post Card



Insurance against carryover — two Armstrong forged steel compound traps draining purifiers on 85000 lb/hr boilers.

How to Insure Positive Drainage of Purifiers, Large Separators and Other Big Units . . .



Automatic, dependable drainage of steam drier in industrial power plant with Armstrong compound steam trap.

● When you run up against a carryover or condensate load too large for ordinary traps to handle safely, Armstrong Compound Steam Traps are an ideal answer. They provide automatic, dependable drainage of loads up to 240,000 lbs/hr at 600 lbs. pressure. They have been thoroughly proved in service on purifiers, separators, driers, storage type hot water heaters, evaporators, vacuum pans and other large units.

Exceptionally high capacity in a relatively small trap is accomplished by a large piston-operated discharge valve controlled by a standard Armstrong inverted bucket trap mechanism. Cast semi-steel and forged steel models are available with 1", 2" and 3" pipe connections. Size, price, simplicity of mechanism, quality of materials and ease of installation are all in their favor.

ASK FOR BULLETIN 215

. . . contains complete physical data, prices and installation notes. Call your local Armstrong Representative or write: Armstrong Machine Works, 810 Maple St., Three Rivers, Michigan

STEAM TRAPS FOR EVERY REQUIREMENT — APPLICATION ENGINEERED

ARMSTRONG STEAM TRAPS

For more data circle 502 on Post Card

ENGINEERS' PREVIEW

FIRST Trade Fair of the Atomic Industry will be held in Washington, D. C., at the Sheraton-Park Hotel, September 26–30. The Trade Fair, which will be held in conjunction with the Atomic Industrial Forum's Fall meeting, will have as its theme Marketing the Products of Atomic Energy.

According to the Forum's executive manager, Charles Robbins, this pioneering Trade Fair will demonstrate the extent to which peaceful atomic energy and its associated products and services have advanced as an important sector of our industrial economy.

There will be displays in such fields as design engineering, package power, medical and research reactors, control systems, reactor materials, instrumentation, construction and fabrication techniques, isotope sources and applications, shielding materials and devices, and reactor components and auxiliaries, in addition to various consultant services.

• • •

AT THE FRANK M. TAIT generating station a $21,500,000 modernization (at the south edge of the city of Dayton) was announced by Kenneth C. Long, president of The Dayton Power and Light Co.

"This is the first step in a program that will give this station an ultimate capacity of 400,000 kilowatts," said Mr. Long. "We are going to remove some of the old and small units and replace them with new and larger equipment. We have two objectives — to stay well ahead of our customer requirements and — to meet rising costs through greater efficiency."

Work has started on the removal of three generators which have been in service for an average of over 30 years each. These small units — two 20,000 kw and one 30,000 kw generators — along with six low-pressure stoker-fired boilers, will be removed by the end of this year. Work will also start on revamping the coal handling and certain station auxiliary equipment.

The old boilers which are now in the southeast corner of the plant will be completely razed to make way for a new high pressure boiler.

By October 1957 the company expects to have a new 125,000 kw General Electric high-pressure turbine in operation. This turbine will be served by a Combustion Engineering-Sulzer Monotube boiler. It will be the first in this country for operation at less than a pressure of 3200 psi. It will supply steam for a pressure of 1800 psi, super-heated and re-heated to 1000 F. When the first unit is completed the station will have a capacity of 275,000 kw.

• • •

WITH A PLAN to tap the ocean's limitless food supply, a Worcester Polytechnic Institute junior has won $25 in the college's Wilfred L. Peel contest.

The plan of Robert L. Diamond and his brother Edward is to process a food supply from the microscopic animal and plant life of the sea.

Science has long pointed to the ocean's teeming microscopic life, called plankton, as the answer to the world's food problem. The difficulty is in catching microscopic "fish."

The most plentiful variety of these organisms is unfilterable by any known commercial process. Diamond's proposal is not to make the mesh of any filtering screen smaller, but to make the diatoms bigger . . . by supersonic vibrations. Plan is to pump sea water through a cylindrical

EDITORIAL AND BUSINESS STAFF

POWER ENGINEERING IS PUBLISHED MONTHLY • 110 S. DEARBORN ST., CHICAGO 3, ILL. DEARBORN 2-5446

EDITORIAL AND ART STAFF

Editorial Director — Richard H. Morris
Editor — Andrew W. Kramer
Executive Editor — Chester R. Earle
Associate Editor — Norman S. Jones
Associate Editor — Robert J. Mitchell
Associate Editor — R. C. Hagenmiller
Equipment Editor — Marian E. Hanlon
Assistant Editor — Irene M. Glen
Editorial Assistant — Mildred Novosel
Staff Artist — James E. Wilcox
Chief Draftsman — Robert W. Koster

OFFICERS AND BUSINESS STAFF

President — Kingsley L. Rice
Executive Vice President — Edwin C. Prouty
Vice President — Walter Painter
Treasurer — Arthur L. Rice, Jr.
Assistant Treasurer — Thomas Walsh
Secretary — Edwin C. Prouty, Jr.
Production Director — John O. Aarvold
Production Manager — Earl R. Noren

Technical Publishing Company is incorporated under the laws of the State of Illinois. Board of Directors: Kingsley L. Rice; Arthur L. Rice, Jr.; Andrew W. Kramer; Edwin C. Prouty; Richard H. Morris.

Subscription Information: Published monthly; price in the United States and its possessions $10, in Canada $11, in other countries $12 per year; single copies $1.00.

Indexed in the Industrial Arts Index and the Engineering Index on file in public and many private libraries.

Micro film edition: Request prices, from University Microfilms, Inc. Ann Arbor, Mich. All volumes since 1948.

DISTRICT MANAGERS

New England — Charles R. Lippold
258 Park Square Bldg., Boston 16, Mass. HA 6-4639
5 Spring St., Riverside, Conn. NEptune 7-2210

New York 17, N. Y. — Joseph Halloran
1613 Graybar Bldg. MUrray Hill 5-3779

Philadelphia, Pa. — Oscar Wilde
1235 Jericho Road (Abington, Pa.) TUrner 6-5968

Pittsburgh 19, Pa. — James B. Tafel
404 Frick Bldg. COurt 1-4878

Cleveland, Ohio (Euclid 23) — F. Allen Schmidt
431 Clearview Drive, Suite D REdwood 2-7734

Chicago 3, Ill. — Warren F. Saas
110 S. Dearborn St. DEarborn 2-5446

McDonald-Thompson offices: Seattle 4, Wash., Harry Abney, 1008 Western Ave., Elliott 3767; San Francisco 5, Cal., Les Meek, 615 Market St., YUkon 6-0647; Los Angeles 5, Cal., Connie J. Grabb, 3727 West Sixth Street, DUnkirk 7-5391; Denver 2, Colo., Robert Heidersbach, 222 Colorado National Bank Building, Keystone 4-4669; Houston 6, Texas, Frank Vickery, Room 214, 3214 Montrose Blvd., LYnchburg 6711; Dallas 6, Texas, Ed J. Whetzle, 5526 Dyer St., FOrest 8-5510.

Copyright 1955 by Technical Publishing Co., Chicago, Illinois. Accepted as controlled circulation publication at Concord, New Hampshire.

Change of Address: Send to POWER ENGINEERING, Circulation Division, Barrington, Illinois. Please supply your position title, company name, company address. Your request must reach us by the 15th of the month to make the necessary change effective with the following month's issue.

PUBLISHED SINCE 1896 FOR POWER ENGINEERS IN PRIVATE AND PUBLIC UTILITIES AND INDUSTRIAL PLANTS

crystal at the precise frequency necessary to cause the tiny particles to collide with one another, to bunch up and to stick together.

Deep sea explorers report that plankton is as thick as soup at the lower levels of the ocean. Diamond, in winning the Worcester Tech prize, outlined a plan for segregating and processing at a cost far below that of the cheapest protein source now available for animal feed.

• • •

E. H. KRIEG, a Stone & Webster Engineering Corp. consulting engineer, and a specialist in the steam power field, has been transferred to the company's New York offices (90 Broad Street) from Boston, his headquarters since joining the company in September, 1948.

Mr. Krieg who, before joining the Boston office of Stone & Webster Engineering Corp., had been consulting mechanical engineer and chief design engineer with the American Gas and Electric Corporation in New York, has been engaged in the design, maintenance and betterment of steam power stations since graduating from Cornell in 1922.

He is a Fellow, ASME; a member, AIEE; and has served for a number of years as a member of the Prime Movers Committee of the EEI.

• • •

A COMMITTEE headed by F. A. Cox, Commonwealth Edison Co., is making final plans for the Fall General Meeting of the American Institute of Electrical Engineers in the Morrison Hotel, Chicago, Oct. 3–7. Fifty technical sessions and symposium, running the gamut of electrical engineering and the allied arts, are planned by a committee, of which R. M. Bergslen of Armour Research Foundation is chairman. Nearly 200 papers will be presented on generation, transmission and distribution, mining, transportation, television, power systems, communications.

In addition to the technical program, a committee chairmanned by D. C. Pearcy, Minneapolis-Honeywell Regulator Co., is planning inspection trips to the Standard Oil Co. refinery at Whiting, Ind.; the General Motors Corp. Electromotive plant at La Grange, Ill.; the Rauland Corp. and the new Will County station of the Commonwealth Edison Co. and the Ford Aircraft plant.

POWER ENGINEERING'S Editors Call on BuDocks

POWER ENGINEERING'S editors visited U. S. Navy's Bureau of Yards and Docks officers and civilian engineers recently to secure data on a maintenance control program the Bureau has developed. Details of this program will be published later

This program will permit more effective maintenance and cost control of all power and utilities installations of the U. S. Navy. Here is shown conference with POWER ENGINEERING editors on the program. L to r: Cdr. T. B. Cocke, manager, Power & Utilities Branch; R. H. Morris, editorial director, POWER ENGINEERING; Capt. A. C. Husband, executive assistant; Capt. E. J. Peltier, assistant chief for maintenance and material; T. E. Hanson; I. W. Rhodes, manager, Maintenance Branch; E. B. Skubik; Capt. A. N. Wallin, director, Maintenance Division; C. R. Earle, executive editor, POWER ENGINEERING; H. K. Lowry, deputy director, Transportation Div. Meeting was in Washington

LETTERS TO THE EDITORS

Fan Control Comment

To the Editor:

IN JOHN F. TOBIN'S article on "What Fan Control Method is Best" in your September 1954 issue, he has done a fine job in listing the advantages and disadvantages of different methods of fan control and the article should prove of considerable interest to the industry. However, perhaps the reader could have been better guided if Mr. Tobin had mentioned the leakage factor through the various type dampers when closed which often prevents good combustion efficiency at the lower range of boiler operation, thus requiring either supplemental dampers or speed control.

We believe that the leakage through the conventional dampers supplied with centrifugal fans is approximately 25 per cent. Thus, when considering the design tolerances in selecting the fan, plus the slight reserve that the fan may have over these design tolerances, these vane dampers even when in the closed position could leak through sufficient air for as much as 35 to 40 per cent of the boiler capacity. Obviously, any lower desired boiler rating would be with high excess air, unless supplementary damper or speed control were utilized.

Perhaps, also, Mr. Tobin's article could have been more pertinent if he had indicated the best method of control for various range of boiler sizes. Obviously the additional costs of fluid drives and magnetic couplings with their controls, would be justified only on those sizes of boilers where the electrical power savings would be sufficient to amortize the additional investment in a satisfactory period.

For standard boilers up to approximately 20,000 lb. of steam per hour and using forced draft motors of 5 hp or less, constant speed operation is the usual rule.

For larger boilers, or fans requiring higher horsepowers, 1800/1200 rpm motors provide savings, because at the lower speed, up to 85 per cent of the maximum boiler output can be handled.

For larger boilers, use of two, three and even four blowers operating in parallel, has produced many advantages. These blowers, with inlet vane controls, can be simultaneously actuated by a common jack shaft and a single combustion controller. Self-closing automatic shutters on the discharge of each blower effectively prevent any outward air leakage through an idle blower. Thus blowers can be placed in or out of service by simply pushing the starter buttons in the control rooms.

Tight fitting *continued on page 106*

Log More Hours!

Log more hours . . . the *extra* hours of peak performance you get when you switch to Sinclair RUBILENE®. RUBILENE guards diesels against sticking rings and prevents excessive wear of moving parts operating continuously for long periods. You will find that RUBILENE lubrication pays off in lowered maintenance costs and your engines log more time between overhauls.

Switch to Sinclair RUBILENE or RUBILENE H. D. Oils. See the difference it can make in your engine log books. Call your local Sinclair Representative or write to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, New York.

SINCLAIR

RUBILENE OILS

For more data circle 503 on Post Card

HERE'S WHAT THEY TELL US

A MANUFACTURING COMPANY in Michigan recently sent us an official purchase order for two copies of A Power Plant Primer to be shipped *via truck* — — we always knew Editor Kramer's Primer was packed with information.

Commercial Engineer H. L. Porter, Municipal Light Meter Bureau, Cleveland wrote

> The Power Plant Primer is the best publication I have ever seen for the man who wonders, *"what makes the wheels go 'round"* in the modern steam generating plant? It certainly gets down to fundamentals.

Copies of A Power Plant Primer are still available and we shall be glad to forward a price list on request.

IF YOU ARE INTERESTED in placing reprint orders for the series "So — You're Going to Overhaul Your Turbine Generator!" now appearing monthly in POWER ENGINEERING, please let us hear from you. The final reprint will consist of some 48 pages. *The more requests there are, the lower the cost will be.* We will certainly let you know the final cost as soon as we are in a position to do so.

W. A. NITKA, Western Electric, asked if the coal map on page 4 of the June 1955 issue was still available. That map was taken from the Fuels and Combustion Handbook, which in turn obtained it from a publication of The Brookings Institution, Washington, D. C., entitled Sources of Coal and Types of Stokers and Burners Used by Electric Public Utility Power Plants by William H. Young. *We sent a photostat copy of the map.*

ANOTHER REQUEST came from The National City Bank of New York; Norman R. Urquhart, Economics Department wrote

> According to E. M. Diffenbach, Agricultural Research Service, Agricultural Engineering Branch, Beltsville, Md., you estimated that the total power capacity for this country was 1¼ billion horsepower about 10 years ago. Do you have a more recent estimate? If so, I would appreciate receiving this total estimate as well as any breakdown of it that is available.

Executive Editor Earle replied

> We estimate that the total installed power capacity of this country, as of 1954, is over 2½ billion horsepower. It must be remembered that this figure, as well as any previous estimates we and others may have made of total U. S. capacity includes a tremendous amount of horsepower installed in the automobiles of the country.
>
> However, here is an extremely conservative estimate of what we think is installed today. The utility and industrial power industry normally gives its capacity in kilowatts rather than in horsepower, but we have converted all these figures into horsepower for your purposes:

Estimate of Installed Power Generating Capacity in the United States in 1954

Utility, Private and Publicly owned —	
Steam Electric Plants	105,000,000 hp
Hydroelectric Plants	30,000,000 hp
Internal Combustion Engine Plants	4,000,000 hp
Total Utility Capacity	139,000,000 hp
Industrial Power Plants	25,000,000 hp
Automobiles (maximum rated capacity)	2,500,000,000 hp
Wind power, farm tractors, railroads, etc.	25,000,000 hp
TOTAL	2,689,000,000 hp

"With three 100,000 kw turbine generators, can you explain why my desk light dims every time I plug in my electric razor?"

KAISER ALUMINUM & Chemical Corp. may reprint the articles from our March, May, June and July issues describing the company's power operations in Louisiana. Glenn E. Weekley, Chalmette, La., wrote

> I understand that the Oakland office is contemplating a brochure reprint of all the articles published by POWER ENGINEERING on the Chalmette power facilities. I think it is an excellent idea and I am looking forward to seeing the finished product.
>
> Incidentally, the articles have been highly complimented by a number of our people here.

Power Manager E. F. Boobyer, Chalmette Works, author of the articles and our Associate Editor Ray Hagenmiller both enjoyed the preparation of this series: Kaiser's Big Chalmette Plant Solves Its Engine Problems; How Kaiser Rectifies Power for Potlines; Chalmette Steam-Electric Plant Flexes Its Muscles; How Chalmette Coördinates Power Facilities and Operations. It should be noted, incidentally, that the heat balance diagrams accompanying the article on the steam-electric plant (pages 78 and 80, June issue) contained errors. These diagrams have been revised and will be available in a corrected version in the contemplated reprint series.

ANSWERING A LETTER from a reader in Pennsylvania, Editor Kramer noted

> In regard to your question concerning the proper location of feedwater regulator, as a rule the regulator is placed between the economizer outlet and the boiler. In other words, the purpose of the regulator is to control water level in the boiler drum itself.
>
> However, in the modern systems, especially in the large single-boiler single-turbine plants, the use of a hydraulic coupling on the boiler feed pump for normal level control of the water in the drum has been increasing, with the regulator considered as supplementary or emergency equipment. Of course, in this case the control of the boiler feed pump controls the water both through the economizer and the boiler itself.

AT MICHIGAN STATE University, formerly Michigan State College, at East Lansing, Professor Harold Skamser of the College of Engineering, is running a Junior Engineering Training for Schools Program (called JETS) which is doing an excellent job in trying to alleviate the present national shortage of engineering personnel.

For detailed information covering the goals and purposes of JETS, also methods of organizing JETS Clubs, write us today. An article on JETS is to be published soon in POWER ENGINEERING.

Improve Heat Transfer ...Reduce Maintenance

by Eliminating Corrosion

Even when an efficient deaerator removes free carbon dioxide from your system, additional CO_2 produced by decomposition of bicarbonates and carbonates remains to cause return line corrosion. Residual oxygen causes pitting. Protecting against both CO_2 and O_2 considerably reduces the cost of replacing and maintaining steam and return lines. Keeping the system free of corrosion products assures high heat transfer efficiency.

One series of Allis-Chalmers corrosion inhibitors solves this problem by neutralization. These materials are blends of the most effective amines selected according to the volatility characteristics required by each steam condensate system. Protection is provided against both CO_2 and O_2 at the points where it is needed.

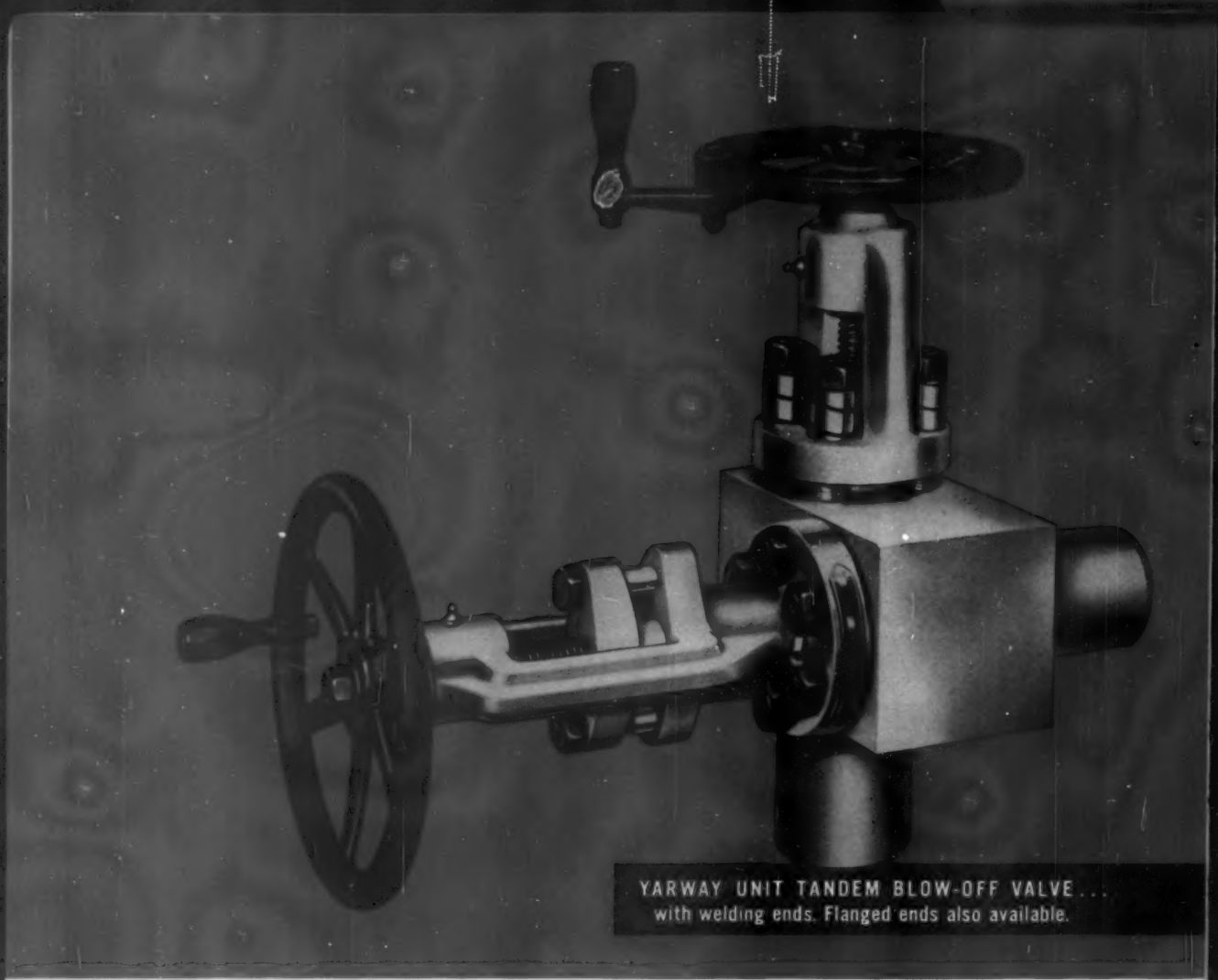
Although recommendations for your specific needs can be made only after thorough analysis, you can get more information about use of this series by obtaining a copy of Allis-Chalmers Water Conditioning Informational Bulletin 50. Get a copy from your nearby A-C office or write Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

Water Conditioning—Chemicals, Equipment, Service—for more than 25 years

A-4605

For more data circle 504 on Post Card



YARWAY UNIT TANDEM BLOW-OFF VALVE . . .
with welding ends. Flanged ends also available.

BUILT TO "TAKE IT" AT

HIGH PRESSURES

● As boiler pressures go up . . . so does the demand for Yarway Unit Tandem Blow-Off Valves. *Why do more than 4 out of 5 high-pressure boiler plants now use Yarway Blow-Off Valves?*

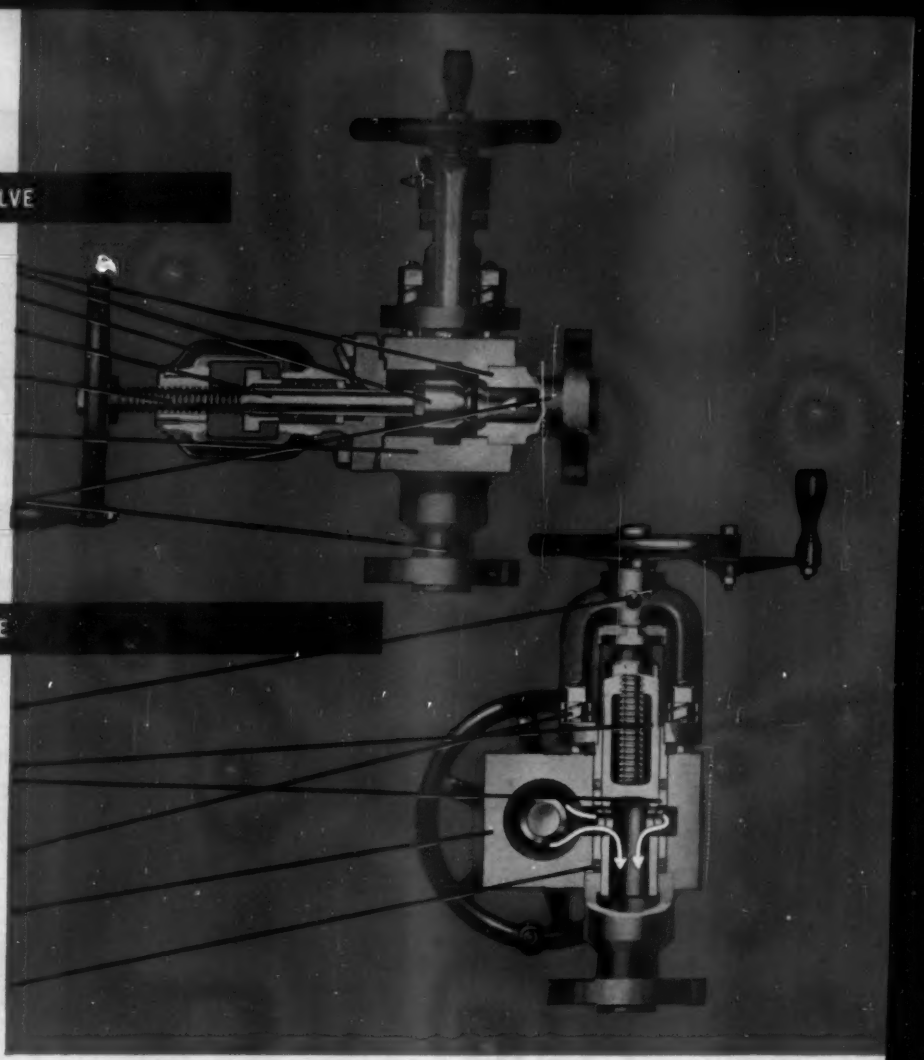
Yarway Unit Tandems are designed for strength, built to safeguard lives and investments, and to withstand severest acid-wash service.

A rugged, compact one-piece forged steel block serves as the space-saving common body for both valves, eliminating intermediate connections. Stelliting on seats and discs in the hard-seat valves provides longer life and better service. Balanced sliding plungers do the same on the seatless-type valves. Other design and metallurgy features add a high safety factor.

A FEW TYPICAL USERS

UTILITIES

Pennsylvania Electric Company
Pacific Gas and Electric Company
Dallas Power and Light Company
Boston Edison Company
Cleveland Electric Illum. Co.



HARD-SEAT (Blowing) VALVE

Stellited and ground disc and seat.

Cast Steel Yoke.

Stainless steel stem.

Alemite lubrication (fitting on yoke hub) of stem and bushing threads.

One-piece forged body of carbon steel. Carbon-moly steel available on request.

Inlet and outlet nozzles welded into body. Flanged or welding ends provided.

SEATLESS (Sealing) VALVE

Alemite lubrication of plunger and ball thrust bearing in yoke.

Nitralloy plunger and lower follower gland. Stainless steel plunger and Ni-Resist gland available for acid wash service.

Yoke springs maintain required pressure on packing at all times.

One-piece forged body of carbon steel. Carbon-moly steel available on request.

Laminated lower packing ring with stainless steel reinforcing inserts.

Unit Tandems are available in the hard seat—seatless valve combination for pressures to 1500 psi, or in the hard seat—hard seat combination for pressures to 2500 psi. Both provide positive opening and closing with drop-tight shut-off.

Write for Yarway Bulletin B-434.

YARNALL-WARING COMPANY

100 Mermaid Avenue, Philadelphia 18, Penna.

BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY® blow-off valves

Toledo Edison Company
Georgia Power Company
Union Electric Co. of Missouri
Rochester Gas and Electric Co.
Indianapolis Power and Light Co.

INDUSTRIAL PLANTS

Bethlehem Steel Company
Ford Motor Company
Weyerhaeuser Timber Co.
Anheuser Busch Company
Procter & Gamble Company

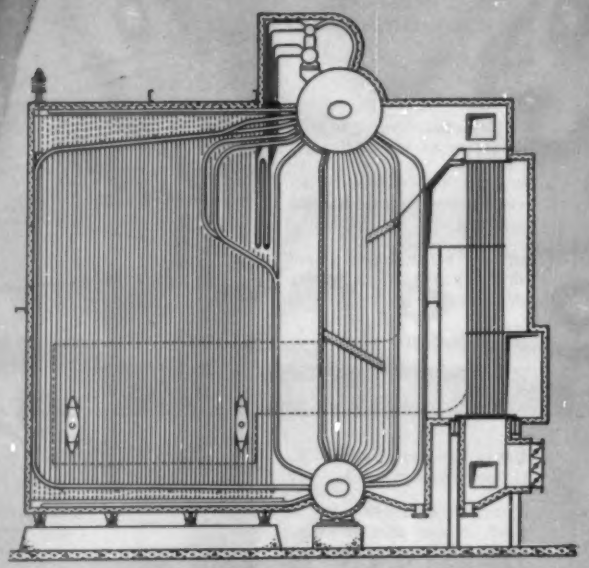
Southern Kraft Corporation
Chrysler Corporation
Container Corp. of America
Eastman Kodak Company
American Viscose Company

one of these C-E standard boilers is....

DESIGNED FOR YOUR PLANT

If your steam needs range between 4,000 and 120,000 pounds per hour, one of these versatile C-E Boilers will give you economical, standout performance. For while they are standard in design (which means lower first cost and proven performance), they're still *flexible* enough to be easily adapted to your exact requirements.

Chances are that one of the C-E standard boilers is the answer to your steam needs. But whatever they may be, C-E can fill them. For C-E Boilers are made in sizes and types for *any* capacity—for *any* pressure—*any* fuel or method of firing.

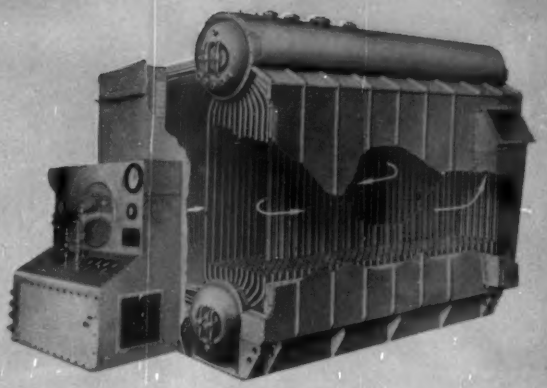


C-E Vertical Unit Boiler, Type VU-55

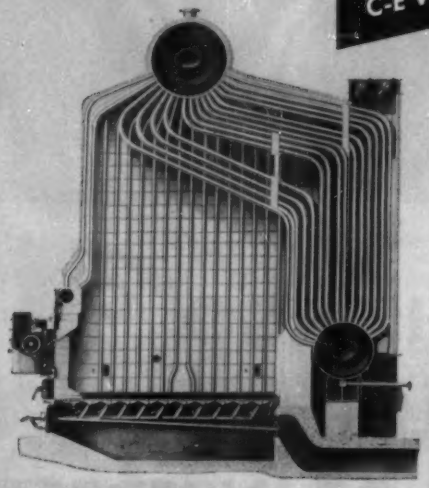
The VU-55 Boiler is available in six sizes ranging from 50,000 to 120,000 lb of steam per hr. It is designed for two pressure ranges—up to 250 psig and to 500 psig. These units are arranged for the application of superheater surface and heat recovery equipment if desired. VU-55 Boilers are designed for the pressure firing of oil or gaseous fuel and require no induced draft fan. They are equipped with tangential burners and tangent tube furnace walls to assure a level of performance which compares favorably with modern utility practice. The VU-55 Boiler is bottom supported requiring no supporting steel structure. The absence of exterior ductwork permits a smooth, streamlined exterior which is both attractive and practical.

C-E Package Boiler, Type VP

This completely shop-assembled boiler is available in fourteen sizes from 4,000 to 40,000 pounds of steam per hour... for operating pressures up to 500 psi... for pressure firing of liquid or gaseous fuels. The VP Boiler has more water-cooled area per cubic foot of furnace volume than any other boiler of its size and type. The large lower drum—30-inch diameter—permits a simple, symmetrical tube arrangement... greater water storage capacity... easy access for washing down or inspection. A centrifugal fan, which operates at low speed and is exceptionally quiet in operation, is standard equipment. The simple baffle arrangement results in low draft loss... simple soot blowing... no dead pockets... high heat absorption. The VP is enclosed in a reinforced gastight, welded steel casing, and shipped completely assembled with firing equipment, fittings and forced draft fan. For foundation, it needs only a simple concrete slab.



C-E Vertical Unit Boiler, Type VU-10



The VU-10 is available in nine sizes from 10,000 to 60,000 pounds of steam per hour... for operating pressures up to 475 psi... superheat to 200° F in 20,000-60,000 lb range... for solid, liquid, or gaseous fuels. This boiler is a completely standardized design adaptable to many conditions. It is bottom-supported and needs no outside supporting steel. It operates efficiently over a wide range of output, and is easy to operate and to maintain. All parts are easily accessible for inspection. The VU-10 is a complete unit—boiler, furnace, setting, fuel-burning equipment, controls, forced draft, heat recovery equipment (if desired). Regardless of fuel, the same general cross-sectional arrangement of drums, convection bank and furnace wall cooling is used. Uniform design through each transverse section assures even water level in the drum and uniform expansion.

A C-E Industrial Boiler for Every Need — Combustion Boilers are available in many other 2-drum designs — for capacities up to 350,000 pounds of steam per hour — and to burn any commercially available fuel. All of these boilers can be designed for use with pressures up to 1375 psi and steam temperatures as high as 960 F—utilize any type of steam recovery equipment—fit difficult space conditions. Let us give you full details on the complete line of C-E Industrial Boilers, including the C-E LaMont Controlled Circulation Hot Water Boilers.

B-852

COMBUSTION ENGINEERING

Combustion Engineering Building, 200 Madison Avenue, New York 16, N. Y.

BOILERS, FUEL BURNING & RELATED EQUIPMENT; PULVERIZERS, AIR SEPARATORS & FLASH DRYING SYSTEMS; PRESSURE VESSELS; AUTOMATIC WATER HEATERS; SOIL PIPE

For more data circle 506 on Post Card

CHICAGO
WILL BE THE TARGET OF INTEREST FOR POWER MEN NOV. 14-18

CHICAGO EXPOSITION of POWER & MECHANICAL ENGINEERING

CHICAGO COLISEUM NOV. 14-18

In conjunction with 75th Anniversary Meeting of ASME

YOUR OPPORTUNITY

to learn how to cut power costs

Whether it's plant modernization, expansion or maintenance you're concerned with, you'll welcome ideas that will help to reduce the cost of your power services. You'll find many of these new ideas at the CHICAGO EXPOSITION OF POWER & MECHANICAL ENGINEERING where you can personally inspect and compare the newest developments in power and allied equipment. You can talk with the technical representatives of leading manufacturers and learn how their products may be applied to reduce *your* power costs and income production.

Under the auspices of ASME, this great concentration of engineering information is timed in conjunction with the 75th Anniversary Meeting of the Society—and only a few minutes away, in the Chicago Coliseum.

If power—it's generation or use—is of importance to your operations, PLAN NOW to attend and see how new power equipment of all kinds can go to work for you.

Be sure to see the new ATOMIC POWER SECTION!

Write NOW for tickets for advance registration and hotel reservation applications.

Additional registration cards available on request.

Management: International Exposition Co.
480 Lexington Avenue • New York 17, N. Y.

CHICAGO EXPOSITION OF POWER & MECHANICAL ENGINEERING
480 Lexington Ave., New York 17, N. Y.

☐ Please send invitation for advance registration
☐ Please send application for Hotel Reservations

Name_____ Title_____

Company_____

Address_____

Type of Business_____

More Efficient Refuse Burning

Read This Article in Power Magazine

RECONDITIONED BOILERS at sugar mill came from irrigation pumping plant seven miles from mill. Mounds in foreground are bagasse fuel. Conveyor brings fuel to refuse feeders shown to right of boiler. Feeder is designed so moist fuel won't jam

Mill burns residue with spreader stokers

Older boilers at sugar mill on island of Maui, Hawaii, gave poor bagasse firing efficiency, were hard to clean. So when time came for expansion, new units got modern firing equipment

By R H HUGHES, *Mill Department Head, Hawaiian Commercial & Sugar Co, Ltd*

▶ OUR EXPANSION PROGRAM at the Puunene Mill, largest sugar factory in Hawaii, called for additional steam-generating capacity amounting to 100,000 lb per hr. Bagasse, residue from making cane sugar, was to be the primary fuel for the boilers furnishing this added steam.

Before expansion, all the boilers were fired with bagasse in step-grate furnaces with natural draft. Poor bagasse firing efficiency and furnace ash disposal difficulties dictated that we look for more modern firing methods for any new units at the cane-sugar-producing mill.

Decision to increase the mill capacity was made in 1951. And to get new boilers then meant extended delay in delivery because of the Korean conflict. Luckily the company had two 800-hp oil-fired Stirling boilers available. These units were at the recently electrified water pumping plant about seven miles from the mill. Inspection proved the boilers satisfactory for further use. So it was decided to go ahead on the basis of moving them to the cane-sugar mill.

Boilers. We contacted the manufacturer for a proposal for conversion of the units. Our needs were as follows: maximum continuous rating of 50,000 lb per hr per boiler operating at 150 psig, saturated steam; mechanical stoker equipment suitable for automatic combustion control for bagasse firing; mechanical removal of accumulated ash on grates.

The boiler manufacturers proposed removing certain generating tubes and

Detroit RotoStokers burn bagasse at the Hawaiian Commercial & Sugar Company, Limited, on the island of Maui, Hawaii. Bagasse is one of many types of refuse fuels, efficiently burned with Detroit Stokers. Others are wood bark, hogged wood, coffee grounds, nut shells, and corn cobs—either separately or in combination with coal, gas, or oil.

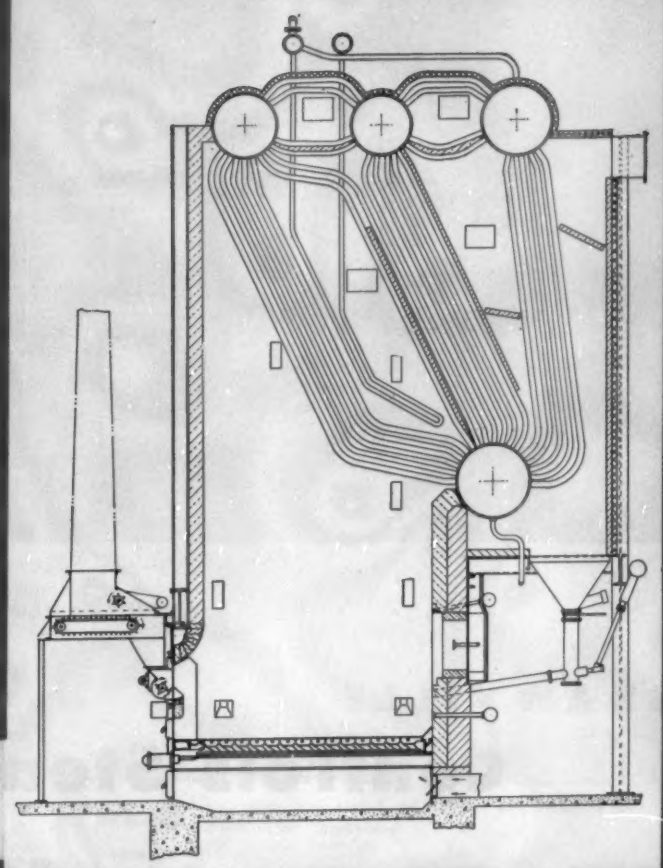
Detroit Stoker refuse conveyor feeders, an original design, automatically meter the fuel according to the load and in proportion to the air supply. The fuel is distributed evenly on the grate.

Each refuse burning installation is engineered to suit the fuel to be burned, the operating conditions, and the boiler furnace.

Write us for this reprint Bulletin 811

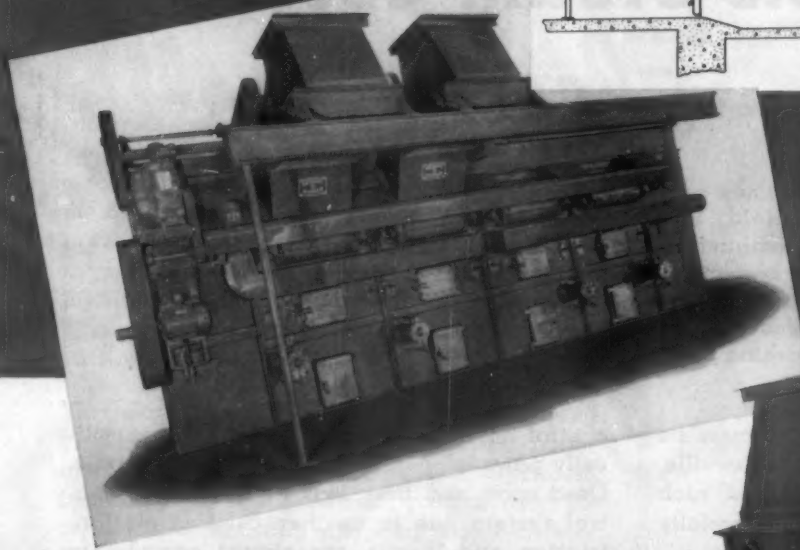
Your Print for Successful Refuse Burning

For producing low cost steam from refuse fuels, use Detroit RotoStokers equipped with refuse feeding rotor units and conveyor feeders. Uniform fuel distribution is assured. Rapid burning with high furnace turbulence is assisted by a properly designed overfire air system.

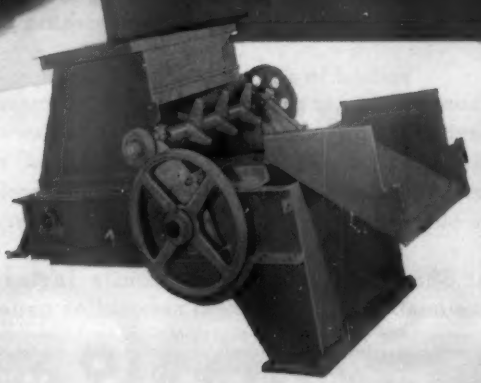


One of two Detroit RotoStokers with power operated dumping grates installed at Hamakua Mill Company, Limited, Paauilo on the island of Hawaii.

Capacity of this unit is 60,000 pounds steam per hour continuously, 72,000 pounds steam per hour maximum, burning bagasse fuel only.



Below is shown one of the refuse conveyor feeders of this Detroit RotoStoker, with hood opened to show the horizontal conveyor and feed control roll.

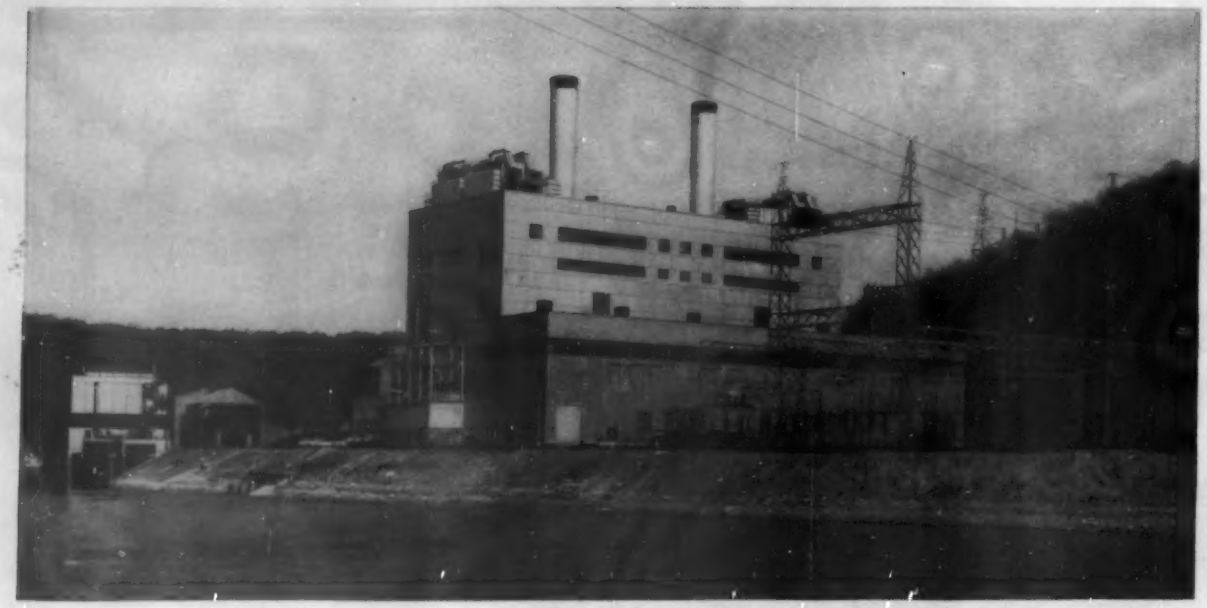


DETROIT STOKER COMPANY

General Motors Building • Detroit 2, Michigan

District Offices in Principal Cities • Works at Monroe, Mich.

For more data circle 508 on Post Card



Shawville Station, Pennsylvania Electric Company—Gilbert Associates, Engineers. Boiler plant consists of two 894,000 lbs. per hour coal fired reheat units operating at 1900 psig and 1055°F/1005°F.

SHAWVILLE

Controls Steam Costs *Electronically*

At Pennsylvania Electric's new central station near Clearfield, Pa., Republic Electronic Combustion Controls instantaneously correct the firing rate when load changes *first* occur—minimize the effect of load swings almost to the vanishing point—simplify feedwater and steam temperature control—eliminate practically all mechanical inertia, friction and lost motion in master control apparatus—transmit control signals with the speed of light—permit more compact, easier-to-operate control panels.

These electronic combustion control features are paying off in lower steam costs for Shawville. In fact, this station produces steam at such low cost that it is able to compete successfully in out-of-state areas over 250 miles away.

At Shawville, electronic circuits instead of pneumatic and mechanical assemblies generate control impulses which are sent to pneumatically powered regulators on boiler auxiliaries. Dead spots and time lags in the master control system due to mechanical lost motion, friction and inertia are almost completely eliminated. And control impulses are transmitted practically instantaneously, thanks again to the speed of electronics.

REPUBLIC FLOW METERS CO.

Electronic combustion controls for Unit No. 2 at Shawville are centralized on this benchboard.

The master impulse for the combustion control system is derived from steam flow. Air flow to the boiler is directly controlled by this impulse. The signal is then modulated by pressure changes in the steam header and sent to coal mills. Variations in the fuel are automatically compensated for. If steam flow falls below or exceeds pre-set limits, the steam flow-air flow control system is automatically blocked out and conventional fuel flow-air flow control substituted.

This control system compensates for load changes so quickly that their effect on boiler operation is practically nullified. Optimum fuel-air ratio is maintained continuously for maximum combustion efficiency. The feedwater system and superheater temperatures are also stabilized, making these quantities easier to control.

REPUBLIC

Automatic

COMBUSTION CONTROLS

(Pneumatic or Electronic)

★ for all sizes and types of boilers
★ for all methods of fuel firing
★ for all load conditions
★ for all arrangements of draft

Write for full details

2240 Diversey Parkway • Chicago 47, Illinois

For more data circle 509 on Post Card

The RILEY

You can't beat it for

METERING COAL FEEDER*
PULVERIZED COAL OUTLET
VARIABLE SPEED DRIVE
CRUSHER-DRYER SECTION
MAIN PULVERIZING SECTION
CRUSHER BLOCK ADJUSTMENT
OIL STORAGE FOR BEARING LUBRICATION SYSTEM IS INSIDE THE PEDESTAL
PULVERIZER SECTIONS ARE MOUNTED INDEPENDENT OF BEARING PEDESTALS

*Can be provided mounted on pulverizer, or separately on floor above.

Latest Model #350 Single Pulverizer with Feeder

Riley has manufactured coal pulverizers since 1925. In 1950 the Riley "50" Pulverizer Series was introduced. Tough, durable Tungsten Carbide applied to pulverizing parts provides extra long continuity of service and low maintenance even with high ash coals. In addition, a crusher-dryer section precrushes the coal, rejects foreign material, and flash-dries the wettest coals, with the result capacity is maintained. Illustration at right shows moving pegs and the pulverizer's accessibility.

#550 Duplex Leaves Riley's Detroit Plant for Colorado

The #550 Duplex, the largest model, is actually a combination of two #550 Single Pulverizers and has a 46,000 lbs/hr rated capacity with 50 grindability coal. Public Service Co. of Colorado has installed seven of these units. Detroit Edison Company has ordered six Duplex Units for a steam generating unit with a capacity of two million pounds per hour.

Cross section of typical #550 Duplex Pulverizer. Coal enters crusher-dryer section (at ends) — here it is precrushed, flash-dried and tramp iron is rejected. Coal is pulverized to required fineness in second sections by attrition. Coal, uniformly mixed with air is blown to burners (center sections).

RILEY DESIGNS, MANUFACTURES AND INSTALLS COMPLETE STEAM GENERATING UNITS AND

"50" PULVERIZER

quiet, safe, dependable, economical operation!

THESE ADVANTAGES *SOLD* THESE PUBLIC UTILITIES

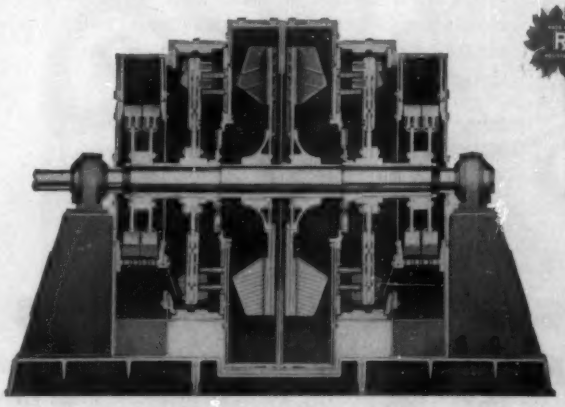
- Tungsten carbide faced pulverizing parts
- No metal to metal contact
- Quiet, vibrationless operation
- Small, overall space
- Low foundation cost
- No loss of capacity with wet coal
- Extreme load range
- Insignificant Btu loss with rejections
- Insignificant handling cost of rejections
- Ease of maintenance
- No adjustments required to maintain fineness
- Low cost maintenance with high ash coals
- Ability to use high primary air temperature with increase in efficiency
- Minimum of lubricating difficulty
- Ease of automatic regulation
- No auxiliary air required for sealing
- Minimum explosion and fire hazard
- Rapid response to load change

*Public Service Co. of Colorado	11-550	Duplex
	1-450	Single
	1-350	Single
*Detroit Edison Co.	7-550	Duplex
Columbus & Southern Ohio Elec. Co.	4-550	Duplex
*Hartford Electric Light Co.	4-550	Duplex
Potomac Edison Co.	3-550	Duplex
Monongahela Power Co.	3-550	Duplex
Northern States Power Co.	3-550	Single
Iowa Electric Light & Power Co.	9-550	Single
Taiwan Power Co.	3-550	Single
Superior Water, Light & Power Co.	2-450	Single
Upper Peninsula Generating Co.	2-550	Single
Utah Power & Light Co.	4-550	Single
Western Colorado Power Co.	2-350	Single
Interstate Power Company	2-550	Single

. . . and these public power stations

Dairyland Power Co-op., Alma, Wis.	3-550	Single
City of Owensboro, Kentucky	3-550	Single
City of Richmond, Indiana	3-550	Single
South Carolina Public Serv. Auth.	6-550	Single
Corn Belt Power Co-op.	2-550	Single
City of Austin, Minn.	2-550	Single
City of Rochester, Minn.	2-550	Single
City of Holyoke, Mass.	2-450	Single
Eastern Kentucky Rural Electric Co-op. Corporation	4-550	Single

**Pulverizers with Steam Generating Units other than Riley's.*



A survey of your plant by a consulting engineer could show ways of making surprising savings in your power costs.

RILEY
Stoker Corporation

WORCESTER, MASSACHUSETTS

Boston, New York, Philadelphia, Buffalo, Washington, Pittsburgh, Cleveland, Detroit, Chicago, Cincinnati, Charlotte, New Orleans, Atlanta, St. Louis, Kansas City, St. Paul, Tulsa, Houston, Denver, Salt Lake City, Los Angeles, San Francisco, Portland, Seattle.

FUEL BURNING EQUIPMENT FOR PUBLIC UTILITY AND INDUSTRIAL POWER AND HEATING PLANTS

For more data circle 510 on Post Card

POSITIVE PROTECTION *plus* GREATEST ECONOMY

NEW Consolidated Safety Valve cuts cost per pound of steam discharged... has maximum capacity designed into minimum flange size... reduces size and/or number of safety valve nozzles required on any boiler... saves installation and maintenance expense.

TYPE 1511
CAST IRON BODY
SAFETY VALVE

ACCEPTED by top industry as a proved Consolidated design.

Type 1511 is a new all-purpose Consolidated Safety Valve expressly designed for steam generator service. It's a space-saver . . . requires less headroom and smaller discharge piping. The spring is exposed to provide stable operation and uniform blowdown control. Greater tightness is assured because of the precision lapped flat seats. Integral, double-guided combination adjusting ring and disc guide contribute to better alignment, easy blowdown adjustment and finer performance. Full range of sizes and orifices available. Get the whole operational and economy story. Bulletin 730 has complete details. Write for a copy.

SIZES: 1½" through 6". **PRESSURES:** Up to 250 psi. **TEMPERATURES:** Up to 450° F. All sizes except 6" available with oversize inlet flanges.

In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario*

CONSOLIDATED SAFETY VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONN.

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'ASHCROFT' GAUGES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Okla.* AIRCRAFT CONTROL PRODUCTS, *Danbury & Stratford, Conn. and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*

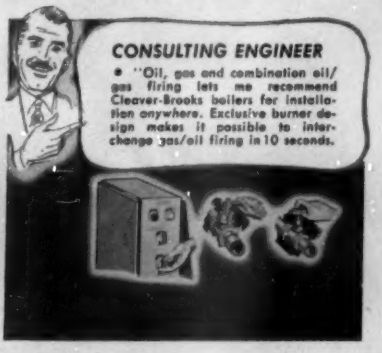
For more data circle 511 on Post Card

CLEAVER-BROOKS SELF-CONTAINED BOILERS HAVE THE FEATURES EVERYONE WANTS!

...which feature would be most important to you?

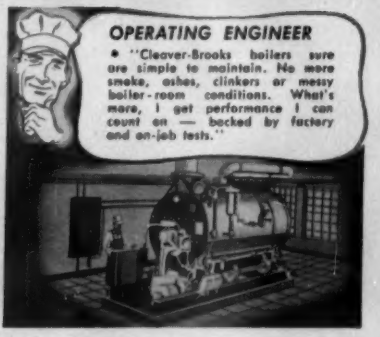
PLANT OWNER
• "Cleaver-Brooks boilers are tops in fuel economy! Forced-draft, four-pass construction and 5 sq. ft. of heating surface per boiler H.P. assure me 80% operating efficiency when firing with oil."

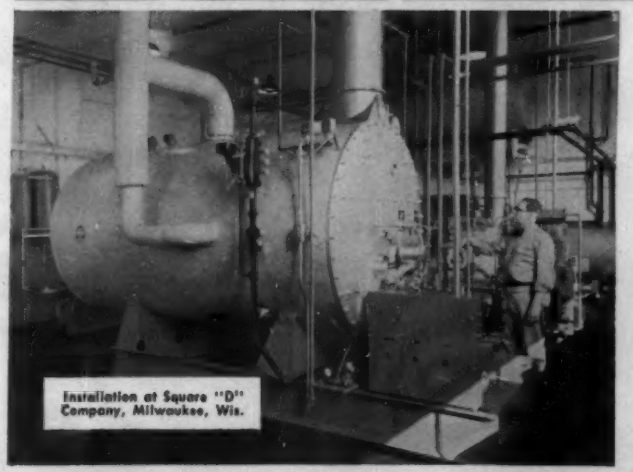
ARCHITECT
• "Self-contained design certainly simplifies boiler room planning — gives owners maximum use from each square foot of space. Gives me flexibility to make best use of low head room conditions."


CONSULTING ENGINEER
• "Oil, gas and combination oil/gas firing lets me recommend Cleaver-Brooks boilers for installation anywhere. Exclusive burner design makes it possible to interchange gas/oil firing in 10 seconds."

CONTRACTOR
• "Boilers are shipped ready to install. With service lines in, my crews have boilers ready for operation in 24 hours or less after delivery. No foundation or stack problems. Cleaver-Brooks furnishes starting service, too."

PLANT SUPERINTENDENT
• "I get all the steam I need for fluctuating steam demands, from full load down to 30% of rating. Automatic burner controls assure instant firing. I call that real dependability."


OPERATING ENGINEER
• "Cleaver-Brooks boilers sure are simple to maintain. No more smoke, ashes, clinkers or messy boiler-room conditions. What's more, I get performance I can count on — backed by factory and on-job tests."



THESE are just a few of the many outstanding features that have made more than 15,000 individual Cleaver-Brooks self-contained boilers *first choice* for commercial, institutional and industrial applications. Get in touch with your nearest Cleaver-Brooks representative for complete facts, or write for catalog AD-100. Cleaver-Brooks Co., Dept. B, 311 E. Keefe Ave., Milwaukee 12, Wis., U.S.A. — *Cable address: CLEBRO — Milwaukee — all codes.*

Cleaver Brooks

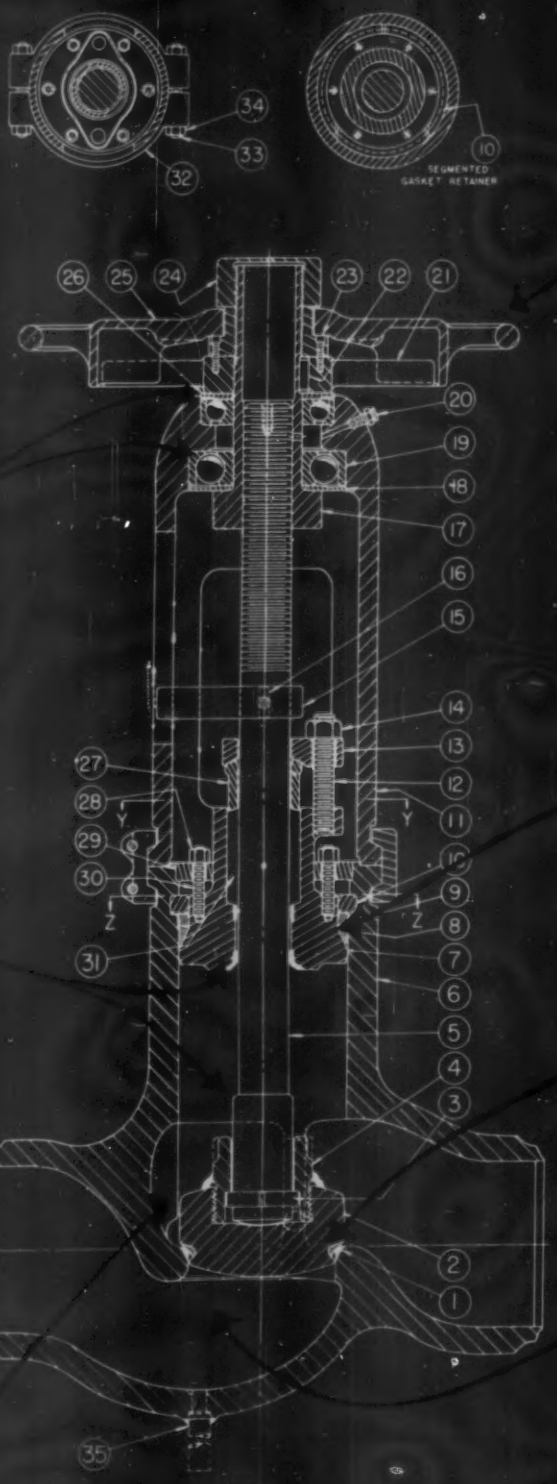
"It's NEW — get the facts on the CB boiler — write today!"

BOILERS — STEAM OR HOT WATER — FOR HEATING OR PROCESSING IN SIZES FROM 15 TO 500 HP, 15 TO 250 PSI.

NOW — FIRST SIZES OF THE CB BOILER ARE MADE IN CANADA, TOO.

For more data circle 512 on Post Card

D.C.H.—
Note comments.
These features
are worth money
to us! C.R.B.



ROCKWELL BUILT *Edward Valves*

LIST OF MATERIALS
QUANTITIES ARE FOR ONE VALVE
WHERE A.S.T.M. SPECIFICATIONS ARE INDICATED, THE LATEST REVISION APPLIES

PC. NO.	NAME OF PIECE	NO. REQ'D	MATERIAL	SPECIFICATIONS	EDWARD M.S. NO.
1	SEAT	1	INTEGRAL WITH BODY	STELLITED	481
2	DISK	1	FORGED ALLOY STEEL WITH STELLITED SEATING FACE	A.S.T.M. A182, GRADE F11 WITH C 0.12% MAX. CR 1.4% MO 1/2%	227 481
3	STEM COLLAR	1	EVALLOY	A.S.T.M. A182, GRADE F6	212
4	DISK NUT	1	EVALLOY	A.S.T.M. A182, GRADE F6	212
5	STEM	1	EVALLOY	A.S.T.M. A182, GRADE F6	212
6	BODY		CAST STEEL C-0.30% MAX	A.S.T.M. A216, GRADE WCB	102
			CAST STEEL C-0.20% MAX	A.S.T.M. A217, GRADE WC6	226
			CAST STEEL C-0.18% MAX	A.S.T.M. A217, GRADE WC9	242
7	BONNET	1	CAST STEEL C-0.25% MAX	A.S.T.M. A217, GRADE WC1	209
8	PRESSURE SEAL GASKET	1	ARMCO IRON-90 BHN MAX	MALLEABLE PLATED	506
9	SPACER RING	1	STEEL		
10	GASKET RETAINER	1	EVALLOY	A.S.T.M. A182, GRADE F6	212
11	YOKE	1	CAST STEEL C-0.30% MAX	A.S.T.M. A216, GRADE WCB	102
12	GLAND STUDS	2	ALLOY STEEL	A.S.T.M. A193, GRADE B7	208
13	GLAND FLANGE	1	STEEL PLATE	A.S.T.M. A212, GRADE B	115
14	GLAND BOLT NUTS	2	STEEL	A.S.T.M. A194, CLASS 1 OR 2	124
15	STEM GUIDE COLLAR	1	STEEL PLATE	A.S.T.M. A212, GRADE B	115
16	STEM GUIDE KEY	1	STEEL	S.A.E. 1020	
17	YOKE BUSHING	1	CAST BRONZE	A.S.T.M. B-148 GRADE 9B-HT	432
18	BEARING WASHER	1	STEEL-EVALIZED	A.S.T.M. A212, GRADE B	115
19	ANGULAR CONTACT BALL BEARINGS			S.A.E. STANDARD	
20	ALEMITE FITTING	1	BUTTON-HEAD INDUSTRIAL TYPE		
21	CROSSARM	1	CAST STEEL C-0.30% MAX	A.S.T.M. A216, GRADE WCB	102
22	CROSSARM KEY	1	STEEL	S.A.E. 1020	
23	HANDWHEEL BUSHING	1	BRASS	A.S.T.M. B62	412
24	HANDWHEEL LOCKNUT	1	STEEL PLATE	A.S.T.M. A212, GRADE B	115
25	IMPACTOR HANDWHEEL	1	CAST IRON	A.S.T.M. A126 CLASS A	301
26	BEARING WASHER	1	STEEL-EVALIZED	A.S.T.M. A212, GRADE B	115
27	GLAND	1	STEEL	A.S.T.M. A105, GRADE II	111
28	BONNET RETAINER NUTS	6	STEEL	A.S.T.M. A194, CLASS 2H	127
29	BONNET RETAINER RING	1	STEEL PLATE	A.S.T.M. A212, GRADE B	115
30	BONNET RETAINER STUDS	6	ALLOY STEEL	A.S.T.M. A193, GRADE B7	208
31	PACKING RINGS		HIGH TEMPERATURE PACKING		
32	PACKING LOCK RING	1	CAST STEEL C-0.30% MAX	A.S.T.M. A216, GRADE WCB	102
33	PACKING RING STUDS	4	ALLOY STEEL	A.S.T.M. A193, GRADE B7	208
34	YOKE RING STUD NUTS	8	STEEL	A.S.T.M. A194 CLASS 2H	127
35	DRAIN NIPPLE		CHROME MOLYBDENUM	SCHEDULE 160 PIPE	229

EDWARD VALVES, INC
SUBSIDIARY OF ROCKWELL MANUFACTURING CO
EAST CHICAGO, INDIANA

EDWARD GLOBE STOP VALVE
PRESSURE SEAL BONNET — WELDING ENDS
GENERAL ASSEMBLY

DRAWN		DRAWING NO.
CHK'D		AE-3297-5
APP'D	DATE	

Edward builds Globe and Angle Stop, Non-Return, Stop-Check, Check, Gate, Blow-Off, Mudline, Relief, Hydraulic, Instrument, Gage, and Special Valves and Strainers.

Steam Generators of offer important savings

Advanced design features of Foster Wheeler "SC" Series Standard Steam Generators mean maximum economy of installation, operation and maintenance

FUELS: Oil or Gas
CAPACITIES: 50,000 to 150,000 lb/hr
STEAM PRESSURES: to 1500 psi
STEAM TEMPERATURES: Saturated to 950 F

The "SC" Series Standard Steam Generator is the latest development by Foster Wheeler toward the reduction of steam costs for manufacturing and process plants. Pre-engineered in all details and standardized for economy, the new units are available in nine sizes with maximum input of over 200 million Btu/hr.

Although dimensions and structural details are fixed, the design provides a wide choice of temperatures and pressures, 48" or 54" upper drums, balanced draft or pressurized firing, type and location of heat recovery equipment, fans and drive, and make of burners for oil or gas firing.

The advanced features of this design, some of which are noted below, contribute to low installation, operating and maintenance expense and maximum dependability under continuous, full-load operation.

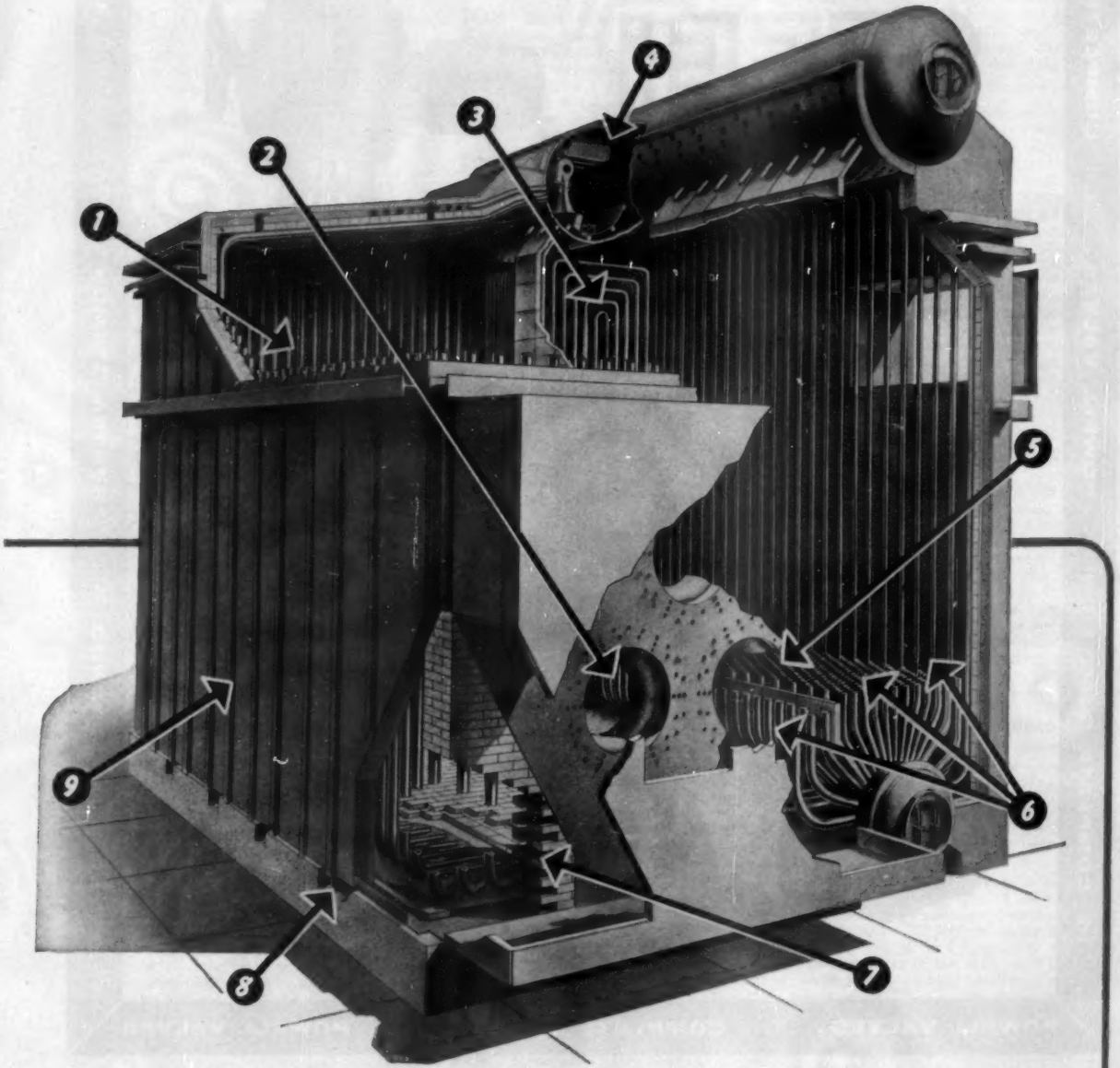
1. **COMPLETELY WATER COOLED FURNACE** with 3" OD closely spaced tubes minimizes setting maintenance and prevents excessive exit gas temperatures.
2. **OVER 19 FOOT FIRING DEPTH** permits long horizontal flame travel with minimum of ineffective or unused furnace volume.
3. **FULLY DRAINABLE SUPERHEATER,** available when superheat is desired, simplifies operation and eliminates a potential trouble spot.
4. **STEAM PURIFYING SYSTEM** consisting of horizontal separators, chevron driers and dry box provides steam purity of less than 1 PPM.
5. **EFFICIENT CONVECTION SURFACE** of 2" OD tubes in a staggered, cross-flow arrangement, combines maximum heat transfer with minimum draft loss. Single-pass boiler section eliminates baffles, dead gas pockets, and further reduces maintenance and draft losses.
6. **UNRESTRICTED CIRCULATION** — Absence of headers provides free circulation through integral risers and downcomers, eliminates header handhole plates and gaskets as possible sources of leakage.
7. **FULL INSULATION** together with the relatively close spacing of the furnace tubes, results in low casing temperatures.
8. **BOTTOM SUPPORTED UNIT** fully utilizes the structural strength of the steel tubes and provides for free expansion of all pressure parts within a stationary casing. This provides low unit stresses in all members and results in a rugged structure that is economical to erect and install.
9. **ALL WELDED CASING** forms a rigid, pressure-tight unit. Possible sources of air and gas leakage are reduced to a minimum, thus providing lower operating costs through more efficient combustion.

LONDON • NEW YORK
PARIS • ST. CATHARINES, ONT.

FOSTER

STANDARD DESIGN

in industrial steam costs



WHEELER

FOR COMPLETE INFORMATION on the "SC" steam generators, write to *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

For more data circle 514 on Post Card

POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

. . . THE COMPLETE QUALITY LINE . . . POWELL VALVES . . . THE COMPLETE QUALITY LINE . . .

POWELL STEEL VALVES

FIG. 11323—1500-Pound Motor Operated Steel Pressure Seal Gate Valve

FIG. 3003 WE—Steel Gate Valve For 300 Pounds W.S.P.

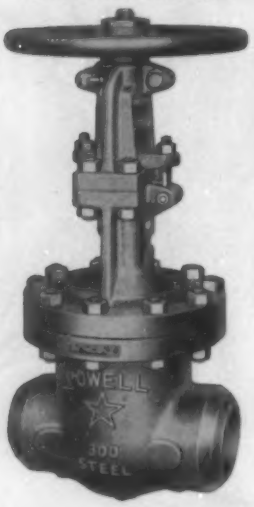


FIG. 11365—Steel Pressure Seal Horizontal Lift Check Valve For 1500 Pounds W.S.P.

FIG. 1314-A—1500-Pound Integral Bonnet Steel "Y" Valve

POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

Wherever flow requires dependable control, there's the place for Powell Valves. Powell can supply just the valve you need, for Powell probably makes more kinds of valves and has solved more valve problems than any other organization in the world.

Shown above are just a few Powell Steel Valves. Investigate their many outstanding features . . . *and the complete line* of quality valves famous for dependable service.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our complete line, and help solve any flow control problem you may have. Write . . .

The Wm. Powell Company, Cincinnati 22, Ohio . . . . . 109th year

For more data circle 515 on Post Card

HELPFUL BULLETINS

MECHANICAL POWER TRANSMISSION

101 Adjustable, Preset Drives — These two bulletins cover ACA adjustable-speed drives, and a-c preset-speed press drives. Bulletin GEA-5568A, 8-pp, features numerous application references for company's ACA adjustable-speed drives, and includes statistics concerning installation and operating factors. Bulletin GEA-5702, 8-pp, emphasizes the versatility of the new AC preset-speed drives and includes a selector chart. General Electric Co.

102 V-Belts — This 24-pp catalog describes company's line of Mor-Grip fractional horsepower and heavy duty multiple V-drive belts. Discusses various types of V-belts as to construction and applications and includes specifications. Among the belts described are super, steel cable, open end and hexagon V-belts as well as V-link belting. Maurey Mfg. Corp.

103 Speed Changer — Operating advantages of Vari-Pitch speed changers are described in 6-pp Bulletin 20B6013D. Arrangement diagrams, a selection table showing recommended unit size for standard motors, and speed range table are included. Allis-Chalmers Mfg. Co.

104 Variable Speed Pulley — Instructions for selecting and installing variable speed pulley systems for industrial power take-off are presented in Bulletin A954-2, 8 pp, on company's Hi-Lo automatic variable speed pulleys. Using formulas and tables, bulletin lists seven steps in the process of securing correct pulley system for the application. Specifications included. Equipment Engineering Co.

FLEXIBLE HOSE

105 Flexible Hose — A set of five new bulletins (Nos. 40 through 44) are of interest to power engineers concerned with flexible hose for dust and fume control, air conditioning and materials handling. They provide general information, data on installation, application suggestions, technical data and prices on hose and accessories. The Flexaust Co.

106 Metal Hose, Joints — Eight-pp Catalog 149 presents flexible metal hose and expansion joints. Both corrugated and convoluted hose types are pictured along with construction details, application suggestions and specifications. Similar data is given on high pressure and low pressure expansion joints. Flexonics Corp.

VALVES AND PIPING

107 Air Conditioning Valves — Catalog R-5, 24-pp, gives size and application data for a complete line of brass valves, accessories, and fittings for refrigeration and air conditioning applications. Incorporates recent technical data on relief valves, check valves and low micron testing of standard line and globe valves. Superior Valve & Fittings Co.

108 Steel Globe Valves — Bulletin 55-A shows major stainless steel globe valves in company's line. In addition to schematic drawings of the various valves, booklet includes a section on design factors, as well as a table of major stainless alloys, giving their designations and applications. Cooper Alloy Corp.

109 Solenoid Valves — This 22-pp catalog consists of a series of bulletins, 85–98, illustrating and describing company's complete line of electrically controlled magnetic valves of the solenoid type commonly used to control the flow of water, oil, brine, chemicals, air solvents, gas and steam. Application, construction and operation of each valve is fully described and cross sectional diagrams explain operation. Specifications and individual prices are tabulated. Magnatrol Valve Corp.

110 High Pressure Reducing Valve — Information on company's Standard Type 345 high pressure reducing and regulating valve is contained in Bulletin S-731. Included are photos and a cross-sectional drawing, recommended uses, description of construction and operation features, capacity, rating and sizing charts and other pertinent data. A. W. Cash Co.

111 Rugged Valves — Eight-pp Bulletin GV-11 presents data on several types of valves designed primarily for the petroleum industry and described as simple, rugged and dependable. A gate valve line blind, self-closing sampling valve, vertical-swing horizontal check valve, and quick-closing valve are shown and described as to design, operation, uses. Greenwood Valve Div., Vernon Tool Co., Ltd.

112 Corrosion-Resistant Valves — Monel and nickel corrosion-resistant valves are described in this informative bulletin. Discusses corrosion-resistant properties of Monel and nickel, listing specific applications for which each is suited. Gives casting composition of both alloys and describes their mechanical properties. Cross-sectional illustrations are included. Alloy Steel Products Co.

113 Butterfly Valves — Bulletin 650-L1A covers company's tight-closing rubber-seated butterfly valves, Model BV. In addition to photos and drawings of valves, there are sections on valve operators, a description of valve components, sizes, pressures, and velocities. Builders-Providence, Inc.

114 Control Valves — Over 40,000 hydraulic and pneumatic control valves are described in illustrated 8-pp Folder 14. Six sizes of valves, ⅛ through 1 NPT are illustrated, along with various actuating devices. Overall dimensions are shown on the photos, actuating devices are explained in detail as are various valve types, solenoid actuated valves and manifold mount valves. Versa Products Co. Inc.

115 Lubricated Plug Valves — Reference Book 39-5 is a 28-pp catalog covering straightway, three-way, four-way and multiple port lubricated plug valves for 250 lb oil-water-gas and 150 lb steam working pressure. Includes dimensions, suggestions for use. Design and construction advantages are discussed. Booklet also presents wrenches and locking devices, extensions and floor stands, and lubricants for use in plug-type valves. Typical installations are pictured. Homestead Valve Mfg. Co.

116 Electrically Operated Valve — This eight-pp technical brochure, complete with flow charts, describes Electroflo — an electrically operated valve for controlling large flow volume. Charts, line drawings and dimensional data supplement text. Hays Mfg. Co.

117 For Piping Economy — Factors involved in piping economy are explained briefly in this 8-pp booklet. Reviews the three important costs — the pipe itself, installation, and maintenance — and shows how higher initial cost of wrought iron pipe is more than offset by long service and reduced maintenance. A. M. Byers Co.

118 Pipe Line Filters — Type PL pipe line filters, designed for removal of water, oil, dirt and pipe scale from compressed air or gas lines, are detailed in Form PLF-446. Contains engineering, operating and application information, and includes a table for quick computing of the correct size filter for a given installation. Specifications on these pipe line filters are included. Air-Maze Corp.

SEALS

120 Hydraulic Seal — Quad rings — their composition, specifications, applications and advantages — are discussed in this 12-pp illustrated folder. Describes methods for installing these hydraulic seals. Typical applications, with all uses shown in photos and cutaway drawings, are presented. Packing gland design, with illustrations and instructions for finding correct groove dimensions, is also covered. Minnesota Rubber and Gasket Co.

New and revised publications reviewed on these pages offer help on operating and maintenance problems. To order, use the Reader Service Cards page 121.

121 Mechanical Seals — Technical data on company's line of Mechanipak seals for rotary shafts are presented in this 6-pp bulletin. Describes important features of design and operation, includes cutaway views of the seals, and lists full specifications. Several specification forms are inserted. The Garlock Packing Co.

ELECTRICAL EQUIPMENT

122 Network Protectors — Bulletin GEA-2017E, 28-pp, covers all phases of a-c secondary networks. Illustrations include numerous diagrams, charts, and photos of the units and their components, with detailed descriptions of their operation. Also included are discussions of fuses and relays in network protectors, as well as full specifications. General Electric Co.

123 On Protective Devices — Bulletin 555 summarizes importance of electrical maintenance and describes testing equipment for assuring proper performance of current acuated protective devices. Describes types of units currently available for preventing equipment failure or outages by preliminary and running safety checks. A recommended procedure of improving maintenance practice through a test record system is also described. The Multi-Amp Corp.

124 Five-Cycle Breaker — Eight-pp Bulletin GEA-6295 presents a five-cycle distribution breaker described as the fastest power circuit breaker available for distribution applications. Contains drawings, information on ratings, dimensions, sizes, weights, other data on breaker and accessories. General Electric Co.

125 Low Voltage Switchgear — Metal-enclosed low-voltage switchgear in indoor and outdoor arrangements is described in Bulletin 18B8283. Outstanding features are listed, and special advantages of the outdoor type are pointed out. Dimensions and ratings of this switchgear for service to 600 v are included. Allis-Chalmers Mfg. Co.

126 Current Controllers — Bulletin EB-1 describes company's Model EB current controller — a pneumatic-electric transducer which provides automatic control of current input required in many types of industrial operations and processes. Bulletin illustrates some typical applications. Conoflow Corp.

You'll save time in ordering bulletins by using the Reader Service Cards on page 121. Of course we honor letterhead requests—but it takes us somewhat longer to handle them.

127 For Service Entrances — Sixteen-pp Bulletin GEA-6286, on fusible service entrance equipment, explains features of seven basic types of entrance devices for commercial and light industrial applications. Describes accessories such as interchangeable raintight box hubs, and contains information on merchandising aids available for use of electrical contractors. In addition, gives ratings, wiring diagrams, dimensions and ordering data. General Electric Co.

128 Thermocouple Assemblies — Features of company's thermocouple assemblies and pressure sealing glands are outlined in 20-pp Catalog 1542. Describes advantages of low mass and fast response to temperature change, tells how the thermocouple glands work. Describes sealants and insulators, stainless steel protection tubes, quick-disconnect thermocouples, stainless steel packing glands, butt welded thermocouples, change-under-pressure glands. Full specifications are included. Conax Corp.

INSTRUMENTS AND CONTROLS

130 Electronic Flow Meters — Publication 55-1074-222, 12-pp, describes company's line of electronic flow meters for measurement of differential pressures, liquid level, fluid, gas, air or steam flow, temperatures and pressures. Points out advantages, describes mercury-less transmitters, transmission system, receiver, integrator, other features. The Hays Corp.

131 High Pressure Meters — Bulletin OG 407, 8-pp, describes company's complete line of ER industrial meters for high vapor pressure liquids such as liquid propane, liquid anhydrous ammonia, and liquid oxygen. Lists specific models for each type of high vapor pressure liquid and explains the Parkhill Wade dispensing system and its advantages. Typical installations for both tank trucks and bulk-handling stations are also covered. Meter and Valve Div., Rockwell Mfg. Co.

132 Automatic Controls — Bulletin S-730 features company's line of pressure, hydraulic, temperature, process and combustion controls. Photos of 27 items in the line of automatic valves, regulators, controllers, hydraulic valves, refrigeration back pressure valves and complete systems for process and combustion control are included, as well as a description of recommended applications, construction and operation features, and range of sizes. A. W. Cash Co.

133 Temperature Monitoring — The Omniguard Temperature Monitoring System as an economical way to monitor remote temperatures is explained and illustrated in 6-pp Publication 3036A. Discusses features of the system, tells how it operates, and provides specifications. Detecting elements and accessories are also covered. Instrument Div., Thomas A. Edison, Inc.

134 Automatic Interlock — Folder 260, 12-pp, describes technical aspects of the Shur-flow automatic interlock. Contains flow charts, wiring diagrams, and application information. The interlock is a device to protect equipment, when flow is below the desired minimum, or above a desired maximum. Industrial Sales Div., Hays Mfg. Co.

135 Sequencing Timing Control — Data Sheet 11.12-1 describes two systems for obtaining sequence timing control, used in water treatment plants, chemical and food processing plants, others, to pace chemical feeders and other equipment. Presents method for operating processing equipment in accordance with specified increments of total flow or weight measurements. Industrial Div., Minneapolis-Honeywell Regulator Co.

136 Boiler Safety Controls — Bulletin P-30, 8-pp, discusses basic safety controls for hot water space heating boilers. It consists essentially of illustrations with accompanying captions. The need for pressure relief valves is shown, along with an explanation of why and how such valves operate. Shows why such boilers must be protected against low water condition, and how feeders and cut-offs accomplish this. McDonnell & Miller, Inc.

WATER TREAMENT

137 Hot, Cold Treatment Units — Technical Reprint T-134, 10-pp, presents a study of factors influencing chemical reactions in hot and cold process treatment units, including effects of type of anion and preformed precipitates, chemical excesses, temperature, varying concentration of preformed precipitates, and contact with magnesium oxide. Test result curves on factors studied indicating what can be expected under various conditions are included, as well as a graphic presentation of both hot process and cold process units. Graver Water Conditioning Co.

138 Mixed Bed Demineralizers — Technical Reprint T-137, 8-pp, discusses treatment of makeup water with automatic mixed-bed demineralizers. A utility installation at which this type of treatment is used is described, giving factors which led to choice of this equipment. A section is devoted to operation of the system and results obtained. The article is illustrated with photos of units and panel, detailed flow sheets and results charts. Graver Water Conditioning Co.

. . . *Outstanding Among This Month's Catalogs*

139 Controlled Humidification — Sixteen-pp Bulletin 500 discusses humidification control, revealing facts about losses caused by dry air during heating season. A detailed explanation of effects of relative humidity on profits, hygroscopic materials, health, dust and static electricity is given. Tables show recommended relative humidities to be maintained for processing and storage of various hygroscopic materials, regain of hygroscopic materials, effect of indoor heating on per cent RH. Lists advantages of steam for humidification. Physical data, prices, selection and installation tips given. Armstrong Machine Works.

140 How Zinc Controls Corrosion — Ways in which zinc lengthens life of steel products, and reduces maintenance costs are detailed in this 32-pp illustrated bulletin. Drawings, charts, and photos together with brief comments present corrosion control characteristics of zinc coatings, zinc pigments, and zinc anodes. An extensive selection of industrial and other applications is reviewed. American Zinc Institute.

141 Industrial Sound System — Key functions of industrial sound systems are described in this 12-pp booklet. Applications of sound and typical equipments are briefly discussed and illustrated. Written in non-technical language, booklet tells how sound can be used to simplify plant administration, coordinate production, improve employee morale, provide effective voice control of all plant functions, and save manpower. Engineering Products Div., Radio Corp. of America.

142 — Activated Alumina Maintenance — This 118-pp book deals with installation and operation of a system for preventing deterioration of power system oils and hydraulic oils. Shows how oils can be kept in prime condition throughout life of power equipment using activated alumina, a granular adsorbent material. Points out savings achieved, discusses installation and operation, describes methods for treating transformer insulating oils. Facts are presented on preventive maintenance of oils used in circuit breakers, oil-filled bushings, oil storage tanks, oil lines, hydro-electric power house equipment and diesel engines. Design and operation of a reactivator is also covered, as well as keeping of cost records. Available to qualified power engineers, please state your job title. Aluminum Co. of America.

SNAP*ON...

the modern, efficient way to insulate pipe

Take a good look at the unique one-piece glass fiber pipe insulation that insulates a 6-foot section of pipe as quick as you can say "Snap*On!" Then picture the savings in your plant when you put Snap*On on large or small, hot or chilled piping.

These on-the-job photos were taken at a midwestern university where large steam distribution lines in tunnels were recently insulated with Snap*On. The job was done in remarkably short time because of the exceptional ease of application. Workmen were pleased to discover that Snap*On weighed only 1/10 to 1/4 as much as conventional insulations — yet was so fibrous-tough that there was no breakage . . . no mess . . . no clean-up time.

An important secondary saving was the heat saving. Tests conducted on the finished job by the university showed the surface temperature of Snap*On to be 50° lower than that recorded on the insulation formerly used!

These are documented facts. The same sort of superior thermal efficiency and low-cost application can be yours if you insulate piping up to 33" in diameter, where temperatures do not exceed 350°. But see for yourself — write today for samples and Technical Bulletin SO-55 today.

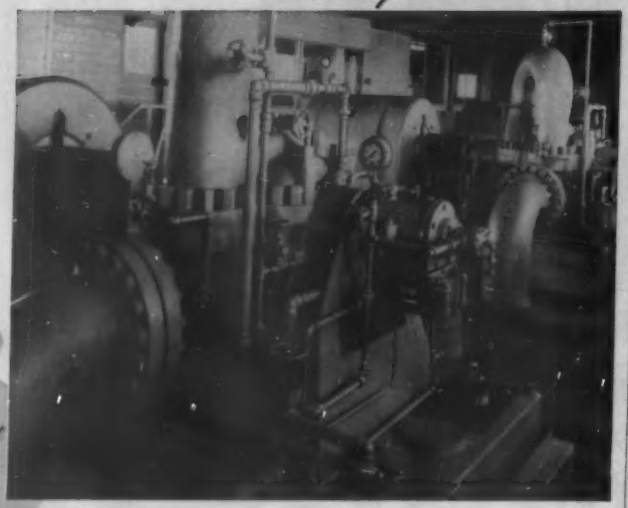
GUSTIN-BACON *Manufacturing Company* GUSTIN gb BACON

Thermal and acoustical insulations • Molded glass fiber pipe insulation • Pipe coupligns and fittings

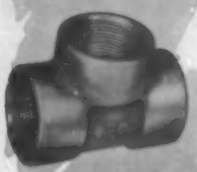
250 W. 10th St., Kansas City, Mo.

For more data circle 516 on Post Card

WATSON-STILLMAN FORGED STEEL FITTINGS



WORK BEST...under pressure



■ In high pressure steam lines...process liquid and gas piping...hydraulic fluid lines...wherever strong, tough pipe joints are needed. Watson Stillman Forged Steel Fittings provide a safety factor against costly piping failures. They resist pressure, heat, corrosion, shock and vibration because they're drop-forged of high quality steel to produce a dense, tough, forged-fiber structure that can really take it.

Extra strength is built into W-S fittings in other ways too...such as the heavy reinforcing bands extending well beyond the threads or sockets.

Protect your high pressure piping system with Watson-Stillman Forged Steel Fittings. Available in carbon, stainless and alloy steels, in Screw-End and Socket-Welding Types to meet your service requirements. Send today for Free Catalogs.

Bulletin A3-50—Forged Steel Fittings
Bulletin S-1-55—Stainless and Alloy Fittings
Bulletin U-1—Forged Steel Unions
Bulletin S-3-55—150 lb. Stainless Fittings

Sold Through Leading Distributors

WATSON-STILLMAN FITTINGS DIVISION

H. K. PORTER COMPANY, INC.
Roselle, New Jersey

For more data circle 517 on Post Card

PUMPS AND COMPRESSORS

143 For Hazardous Liquids — Catalog Section D, 12 pp, presents company's line of Underwriter pumps for handling hazardous liquids. Both mechanical seal and deep stuffing box models are shown and dimensions and specifications provided. Various mounting arrangements and drives available for these UL approved pumps are also cataloged, and application suggestions are given. Also in this booklet are performance graphs, selection table, and explanation of the positive displacement principle utilized in these rotary pumps. Viking Pump Co.

144 Jet Pump for Ash Handling — Design, construction, installation and operation of company's Hydro-Ejector is covered in Data Sheet Ea. Shows application of this jet pump in hydraulic materials handling systems, for pumping a mixture of solids (such as boiler bottom ash or iron pyrites) and water through a pipeline. Includes helpful table of capacities. Allen-Sherman-Hoff Co.

145 Controlled Volume Pumps — Bulletin H20-1 describes company's controlled volume pump model H-20 designed for accurate chemical feed at low cost. Complete information includes data on simplex and duplex models, capacities, pressures, materials of construction and mounting dimensions. Milton Roy Co.

146 Oil, Gas Compressors — Illustrated Bulletins 604 and 605 give brief application and construction information on two types of single-stage, double-acting horizontal straight-line compressors designed to compress air or gas free of oil or oily vapors. Large sectionalized views are provided. Pennsylvania Pump & Compressor Co.

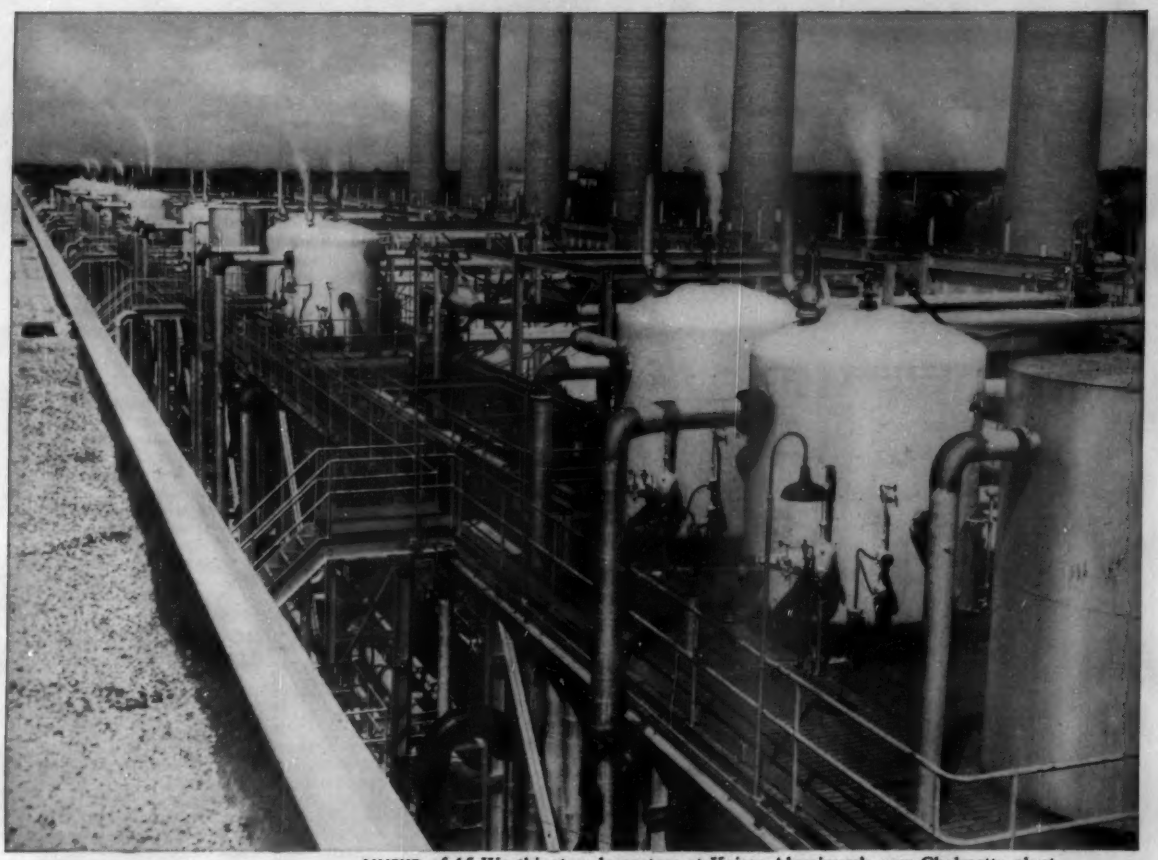
BOILERS AND AUXILIARIES

147 Packaged Generators — This 16-pp catalog covers a new series of packaged steam generators in sizes from 10,000 to 46,000 lb of steam per hour. Gives capacities, dimensions, construction features. Instrumentation is discussed. Illustrations include sectional drawings and installation photos. Booklet also provides a selection chart on firing equipment and controls. Foster Wheeler Corp.

148 Compact Generator — This bulletin describes a packaged water tube generator, company's Type DK, available in units for 8400 to 45,000 lb of steam per hour. Gives features, size and capacity data on these boilers which are designed to require less space than many water tube units. E. Keeler Co.

149 Standard Generators — Bulletin B-55-4 describes company's 8C economy series of standard steam generators designed to reduce steam costs for industrial plants. Pre-engineered, standardized steam generators offered in nine sizes, with capacities of from 50,000 to 150,000 lb per hr are described, and schematic and cutaway drawings of the units and design features included. Foster Wheeler Corp.

150 Small Deaerating Heater — Technical Bulletin WC-118 features small size deaerating heater for use in small steam generating plants. Design, operation and application facts are detailed. Photos and cross-sectional diagrams illustrate construction and installation features, and sizing charts indicate space requirements,



LINEUP of 15 Worthington deaerators at Kaiser Aluminum's new Chalmette plant.

Biggest U.S. aluminum plant has 15 Worthington deaerators

Kaiser Aluminum's mammoth new reduction plant at Chalmette, La., turns out 12½ pounds of aluminum *every second.*

It takes nearly half a million kilowatts (enough to power a city of 1 million) to sustain Chalmette's rated production of 400 million pounds a year. And the Worthington nameplate pops up everywhere you look in Chalmette's two big powerhouses.

The deaerators are Worthingtons — 15 of them, each with a capacity of 250,000 pounds per hour. These compact and efficient deaerators are of the Full Contact Steam Jet Type. Vent mixture is effectively concentrated by direct contact within the deaerator shell, thus obviating the need for a surface type vent condenser. A troublesome source of maintenance is thereby eliminated, installation is simplified, and cost of lagging is substantially reduced.

Worthington condensers, condensate and circulating pumps, boiler feed pumps and deaerators are all helping to keep Kaiser's Chalmette plant on the line. For the whole story on Worthington deaerators write for Bulletin W-210-B32 today. Address Worthington Corporation, Steam Power Division, Harrison, New Jersey. **8.43**

"SEE the Worthington Corporation Exhibit in New York City. A lively, informative display of product developments for industry, business and the home. Park Avenue and 41st Street."

WORTHINGTON

A GREAT TEAM IN STEAM

Steam-Jet Ejectors and Vacuum Pumps • Boiler Feed Pumps • Deaerators • Steam Turbines • Surface Condensers and Auxiliaries

For more data circle 518 on Post Card

The Ideal Packing for Centrifugal Pumps
"JOHN CRANE"
SUPER-SEAL®
over fifteen years of outstanding service records
...Now with "tape-back" reinforcement
★ SIMPLIFIED RING CUTTING—Easily pulled down to any shaft or stem size.
★ POSITIVE PACKING IDENTIFICATION—Each style marked in a different color.
Super Seal is an extremely resilient, graphite impregnated, homogeneous plastic packing composed of asbestos, metallic particles and special binders.
This packing is ideal for centrifugal pumps in a wide variety of power plant services. It doesn't give up its lubrication, it stays resilient and it won't score shafts. You'll find it will outlast any packing you've tried. There are no continual adjustment problems with Super Seal, because it stays put!
"Tape-back" construction meets your need for flexibility without breakage—for ring cutting without waste. Here, for the first time, is a plastic packing which can be handled as easily as braided fabric styles.
It's hard to believe the resilience of "tape-back" SUPER SEAL until you twist it down yourself. Send for a sample and try it.
Crane Packing Co., 1859 Cuyler Avenue, Chicago 13, Illinois.
In Canada: Crane Packing Co., Ltd., 617 Parkdale Ave., N., Hamilton, Ont.
JOHN CRANE
CRANE PACKING COMPANY
OFFICES IN ALL PRINCIPAL CITIES
INDUSTRIAL PROGRESS
For more data circle 519 on Post Card

capacity, amount of storage of deaerated water, and sizes of accessories furnished. Graver Water Conditioning Co.

TUBING

151 Stress-Rupture Data — Of interest to power engineers concerned with stainless tubular products in steam superheaters, heater coils in oil refinery heaters and petrochemical plants and high-temperature piping installations, this data card gives stress rupture properties of chromium-nickel stainless steel weld deposits. Based on a study of high-temperature rupture properties of stainless weld metals, the card furnishes a quick summary of results. Tubular Products Div., The Babcock & Wilcox Co.

152 Fin Tubing — Bulletin 1300 is of interest to power engineers concerned with fluids being heated, cooled or condensed by other fluids with different heat transfer characteristics. Tubing described has longitudinal fins which afford much greater exterior surface. More than a dozen ferrous and non-ferrous material combinations are tabulated. Bulletin also explains how tubes are made and gives sizes of fins and tubes. The Griscom-Russell Co.

AIR CONDITIONING AND DUST COLLECTION

153 Air Conditioning Units — Twenty-pp Bulletin 8127 describes central-station, cabinet-type air conditioning units. Profusely illustrated, bulletin covers three types of air conditioning units for industrial and commercial applications. Units providing air circulation, cooling and dehumidifying, heating, air cleaning, humidification and damper control in a capacity range from 600 to 48,000 cfm are covered. Tables and graphs give data on selection of units to meet individual job requirements. Unit arrangements shown. American Blower Corp.

154 On Dust Collection — Specifications and descriptive details about company's Hydro-Filter is contained in 12-pp Bulletin 55. Covered are details on how unit uses filtering principle to trap dust by impingement on glass spheres; entrapment on bubble surfaces and containment within water droplets. Separating efficiencies, application data, construction and design as well as a description of models and capacity range available and description of laboratory facilities are included. National Dust Collector Corp.

Bulletins reviewed here are offered primarily for qualified power engineers. Manufacturers may withhold literature from persons who do not state their job title and company. Some manufacturers also prefer not to send literature to those in foreign countries in which they have no sales representatives.

155 Wet Dust Collector — Power engineers, faced with the problem of control of hot or moist, explosive or combustible, corrosive, abrasive or obnoxious dusts will be interested in Bulletin 919 describing company's Type CW-1 centrifugal wet dust collector. Photos, line drawings and tables give complete data on

here's how high temperature piping can flex its muscles

Each pipe hanger is scale tested to rigid tolerances by a skilled workman at the Navco plant. After final assembly and inspection, the hangers are carefully crated and readied for shipment.

NAVCO *Counterpoise* Pipe Hangers

Since high temperature piping has no respect for equipment connections, the entire piping system must flex its muscles to absorb the strain of expansion and contraction. This prevents serious stresses that could endanger the installation.

And how does high temperature piping flex its muscles? With Navco's precision engineered Counterpoise Pipe Hanger—the hanger with a load-supporting effort that is of constant value throughout the range of travel. This permits weightless movement of the entire piping system.

To learn how power plants, oil refineries and chemical plants can have piping systems that flex their muscles, write today for Navco's 12-page Counterpoise hanger bulletin #153.

NAVCO

NATIONAL VALVE & MANUFACTURING COMPANY

3105 LIBERTY AVENUE, PITTSBURGH 1, PENNSYLVANIA

New York • Chicago • Cleveland • Boston • Atlanta • Buffalo • Cincinnati

For more data circle 520 on Post Card

ACCESSIBILITY

is built into the
Continental
BOILER

. . . saves production time
. . . saves maintenance dollars

Rugged, simple in design, accessible—that's the Continental Automatic Boiler. Here are a few reasons why it's easy to keep this packaged steam generator at peak efficiency:

- Openings are provided to facilitate inspection of steam and water space.
- Both front and rear doors are hinged—affording quick access to furnace and return tubes.
- Cleaning, when necessary, is easy. One man can open both doors in a matter of minutes.

AND HERE'S WHY CONTINENTAL BOILERS STAY EFFICIENT FOR A LONG TIME:

- 2-pass design eliminates refractory baffles in front and rear which may burn out, leak and cause short circuit of gases.
- *All* return tubes are subjected to the same temperature and do equal work . . . and there is more uniform longitudinal expansion of the pressure vessel.

Send for Bulletins BE3-4 . . . and let us bid on the next boiler you need.

Used for high or low pressure steam and for hot water applications, Continental Boilers are fully automatic, range from 20 to 500 hp. and can be gas, oil or combination fired. Over 80% efficiency is guaranteed.

Continental AUTOMATIC BOILERS

BOILER ENGINEERING
and Supply Company, Inc.

2 Manavon Street
Phoenixville, Pa. Phone 5832

For more data circle 521 on Post Card

counter current, wet collector of tower construction. Pangborn Corp.

OTHER EQUIPMENT

157 Steel-Belt Conveyors — This 48-pp, hard-cover book gives extensive engineering and application information on company's solid steel-belt conveyors. Illustrated with photos and drawings, book describes basic features and gives details on characteristics, capacities, adaptations and design. Typical steel belt conveyors as used in a variety of industries are described, along with conveyor components such as idlers, drive, discharge devices. Construction of typical conveyor is described, and properties of stainless and carbon belts are discussed. Standard widths and thicknesses for both single and longitudinally jointed belts are given, also load capacities. Sandvik Steel-Belt Conveyors, Div. Sandvik Steel, Inc.

158 Vibrating Screen Separators — Catalog 112-177, 22-pp, features photos, drawings, detailed specifications of separating equipment now screening more than 241 different materials. Application data in the following industries: stone, clay, glass, food, chemicals, lumber, textile, paper, petroleum, metals, rubber, waste and pollution control are collected. A complete data file accompanies this bulletin. Southwestern Engineering Co.

159 Lubricating Equipment — Catalog 104, 26-pp, features company's line of industrial lubricating equipment and accessories, including lubricators, gun fillers, hand guns, power guns, portable lubricators, pumps for transfer and supply, hose reels and accessories. Construction and operation advantages are outlined and specifications listed. The Aro Equipment Corp.

160 Signs for Safety — Illustrated in full color, this 48-pp catalog covers some 2200 stock metal signs and safety tags. The signs are made in ASA specifications for industrial accident protection, and some are available in foreign languages. Catalog also shows porcelain enamel and stainless steel letters in sizes to 24-in. high for constructing display signs, and includes a section devoted to special signs made for specific accident prevention problems. Ready Made Sign Co., Inc.

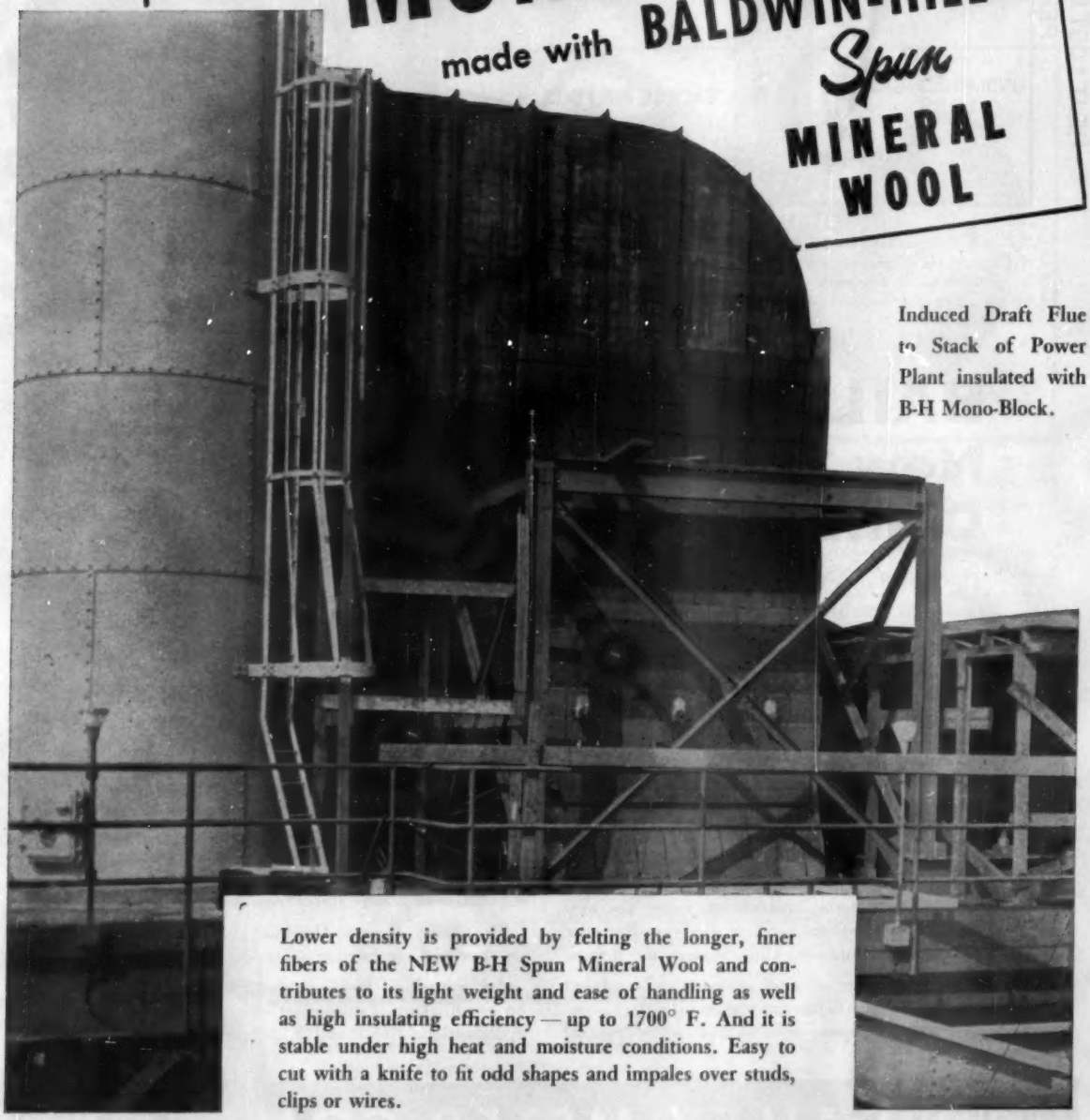
161 Long-Stroke Diaphragm — Sixteen-pp loose-leaf Catalog BF150 describes in detail various classes of long-stroke, deep convolution, diphragms. Included are table of standard sizes, available materials, dimensional data tables, and design data. Illustrated with photos and application drawings, it will be kept current by subsequent technical mailings. Bellofram Corp.

162 Laboratory Equipment — "Labaratus 1955" is a 66-pp catalog supplement covering some 14,000 instruments and other equipment for laboratory use. All items are illustrated and described as to features and application, and a current price list is included. Central Scientific Co.

163 Constant-Force Spring — More than 25 design applications of company's Neg'ator constant-force spring are described and illustrated in 16-pp Technical Bulletin 310N. Demonstrates how spring is being used in solving a variety of mechanical-loading and power-drive problems to provide improved performance with fewer components and savings in space, weight and cost. Hunter Spring Co.

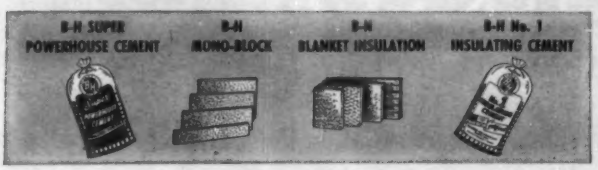
NEW LIGHTWEIGHT MONO-BLOCK

made with BALDWIN-HILL *Spun* MINERAL WOOL



Induced Draft Flue to Stack of Power Plant insulated with B-H Mono-Block.

Lower density is provided by felting the longer, finer fibers of the NEW B-H Spun Mineral Wool and contributes to its light weight and ease of handling as well as high insulating efficiency — up to 1700° F. And it is stable under high heat and moisture conditions. Easy to cut with a knife to fit odd shapes and impales over studs, clips or wires.

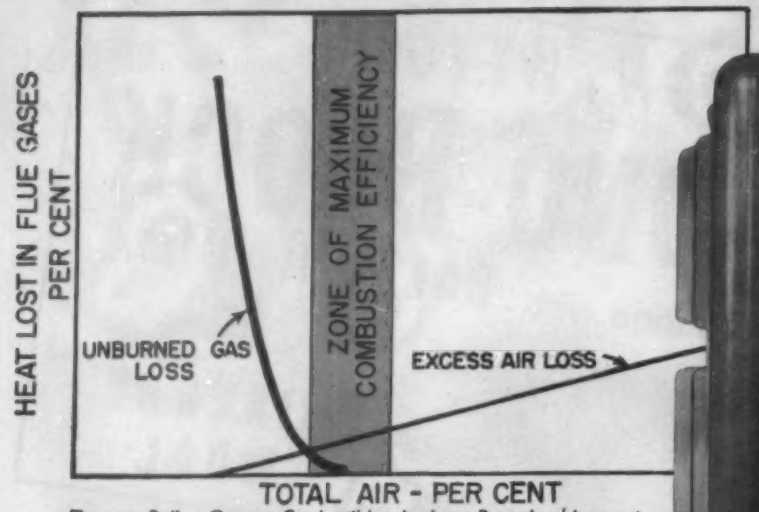


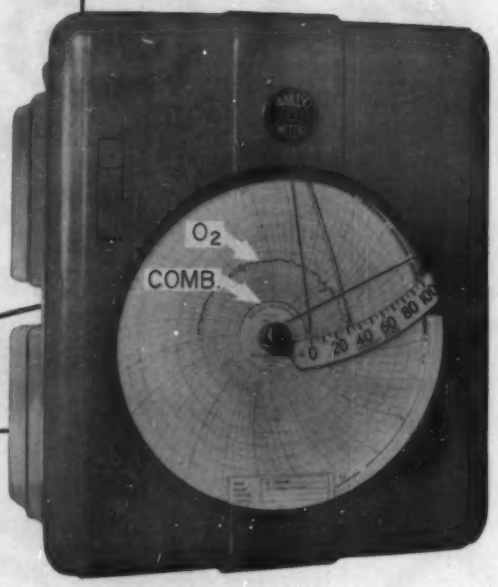
BALDWIN-HILL COMPANY

209 Breunig Ave. Trenton 2, N. J.

Kalamazoo, Mich. Huntington, Ind. Temple, Texas

For more data circle 522 on Post Card


HEAT LOST IN FLUE GASES PER CENT
UNBURNED GAS LOSS
ZONE OF MAXIMUM COMBUSTION EFFICIENCY
EXCESS AIR LOSS
TOTAL AIR - PER CENT



The new Bailey Oxygen-Combustibles Analyzer-Recorder (shown at right) provides a continuous two-in-one check of combustion efficiency by recording both oxygen and combustibles in flue gas. As shown by above chart, both measurements are needed to determine combustion efficiency.

BAILEY announces . . .
New 2 in 1 way to measure Combustion Efficiency

The new Bailey Oxygen-Combustibles Analyzer-Recorder gives you a continuing double check on combustion economy. It's fast response measures and records:

1. Excess air—regardless of the fuel or combinations of fuels being burned.

2. The mixing efficiency of your fuel-burning equipment—by indicating the amount of combustibles in your flue gas, resulting from incomplete mixing of fuel and air.

Combustion efficiency depends upon fuel-air ratio. Too much fuel can be even more costly than too much air. And because of the interdependence of these two factors, no control that measures only one of them can give you complete protection.

Now, for the first time, you can check *both* with a *single* fast acting instrument, using the new Bailey Oxygen-Combustibles Analyzer-Recorder for industrial furnaces, kilns, heaters and boilers.

Fuel economy improves as excess air is reduced —until unburned fuel begins to show up in the flue gas. When this happens, combustion efficiency drops off sharply if there are further decreases in the air-fuel ratio. That's why combustion gases must be analyzed for *both* oxygen and combustibles to get a true indication of efficiency—and that is why Bailey coordinates both measurements on the same chart, to show when excess air may be reduced safely without danger of greater losses from unburned gases.

The Bailey Oxygen-Combustibles Analyzer is an approved combustion safeguard.

Ask your local Bailey engineer for suggestions on application. Equipment details in Product Specifications E65-1 and E12-5, P31-1

BAILEY METER COMPANY

1040 IVANHOE ROAD • CLEVELAND 10, OHIO

INSTRUMENTS AND CONTROLS

For Power And Process

For more data circle 523 on Post Card

TRADE PAPER EDITION
Published by
SCHUTTE and KOERTING
Company

ENGINEERING News

JET APPARATUS • HEAT TRANSFER EQUIPMENT • STRAINERS • CONDENSERS AND VACUUM PUMPS • OIL BURNING EQUIPMENT • ROTAMETERS • FLOW INDICATORS • RADIAFIN TUBES • VALVES • SPRAY NOZZLES AND ATOMIZERS • GEAR PUMPS • DESUPERHEATERS

Why Should You Come To SK For Standard Or Special Heat Transfer Equipment?

Have you, or are you likely to have, a problem in Heat Transfer involving *special* heavy duty equipment? Does your problem involve out-of-the-ordinary materials, highest precision and uniformity requirements, better than ordinary test and quality control facilities? Would you like to have technical assistance from HT specialists with wide experience?

Or do you just need a well designed, carefully built standard Heat Transfer Unit?

SK manufactures standard equipment, designs and builds special equipment for heat transfer service for pressures up to 5000 psi, temperatures to 1100° F.

And, *here's why* you should come to SK for such equipment—

All SK Heat Transfer Units feature: (1) close tolerances between tube OD and tube sheet hole ID; (2) polished tube ends to insure best metal to metal joint between tube OD and tube hole; (3) shell bores to exact tolerances to insure close fitting baffles for top efficiency; (4) rigid inspection of materials, methods, final assembly; (5) A.S.M.E. Code qualifications; and (6) electronically controlled tube expansion*. SK is particularly well equipped to solve unusual HT requirements, because . . .

70-30 cupro-nickel tube bundle, 36" diameter x 30' long, 1452 tubes of ⅝" OD, 18 BWG for corrosive liquid

SK has specialized in HT problem solving for a great many years—is set-up operationally for this.

The engineering staff is experienced—includes Chemical, Industrial, and Mechanical Engineers who *understand* chemical, power, processing, marine requirements, who *think* on the level you will require, who *talk* your language.

SK research facilities are set up to *anticipate* future requirements.

Production facilities are such that the company has been able to provide radiafin air coolers rated at 7500 hp weighing 47,000 lbs. . . . heat exchangers with special Everdur tube bundles, shells and head lining . . . 36" diameter, 30' long cupro-nickel units for cooling sodium carbonate solution for liquid rheostats . . . special units for handling hydrocarbon gases and synthetic rubber.

Quality Control and test facilities include equipment for hydrostatic, magnaflux, pneumatic, temperature shock, polariscope testing and radiographic inspection (250,000 Volt X-ray machine; Cobalt 60).

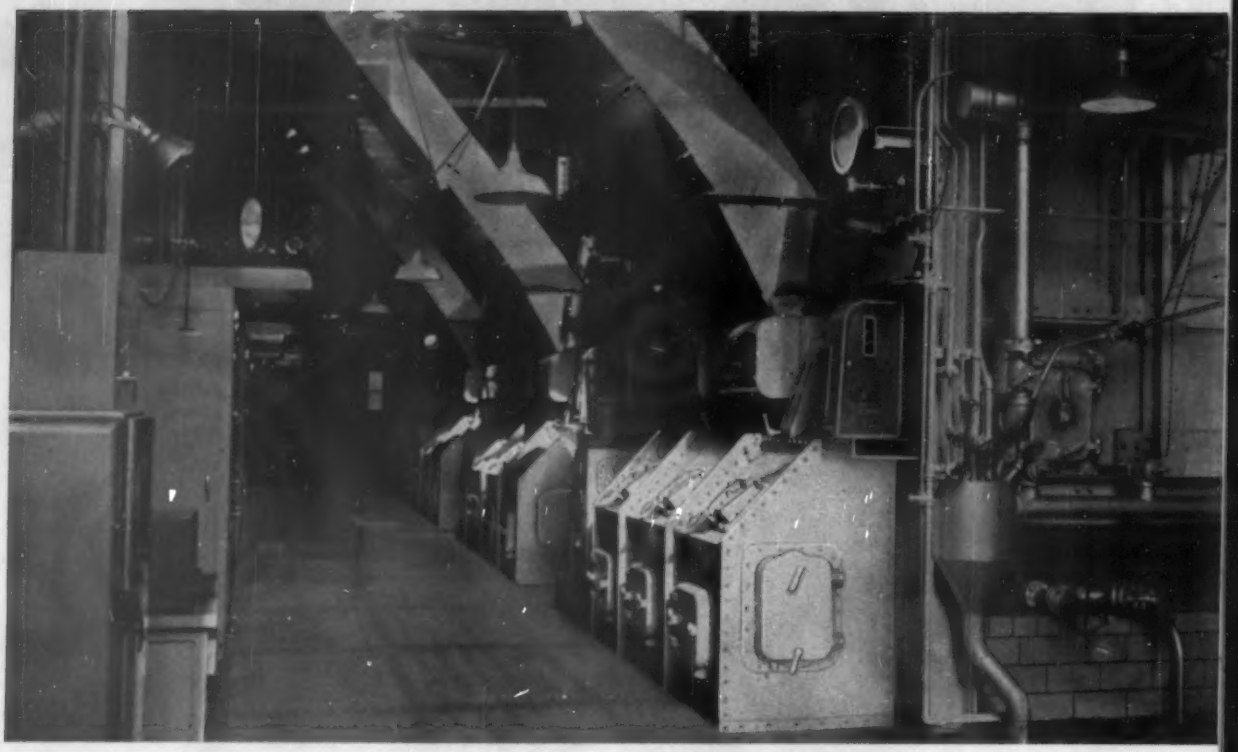
Space will not permit many other details worth noting but, if you want more information, do this: (1) write for Bulletin HT-1 which describes the type equipment we make, or (2) request a copy of Vol. 5 No. 3 Engineering News which contains an article on our problem-solving facilities.

***Tubes being expanded using electronically controlled tube rolling machine. This method provides advantages as follows: (1) every tube is expanded uniformly with no over or under expansion, (2) there is no enlargement of tube holes, (3) ligament fracture is prevented, (4) there is minimum tube elongation and tube sheet warpage is reduced, (5) tube wall stresses are reduced, (6) guess work is eliminated, ideal standards for tube joints apply.**

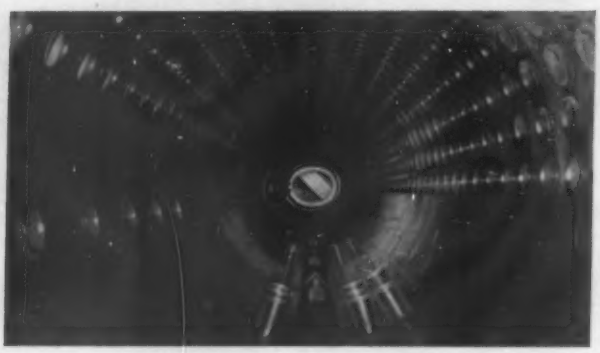
SCHUTTE and KOERTING Company
Manufacturing Engineers
2221 STATE ROAD
CORNWELLS HEIGHTS
BUCKS COUNTY, PA.
Representatives in Principal Cities

For more data circle 524 on Post Card

Dearborn gives a new

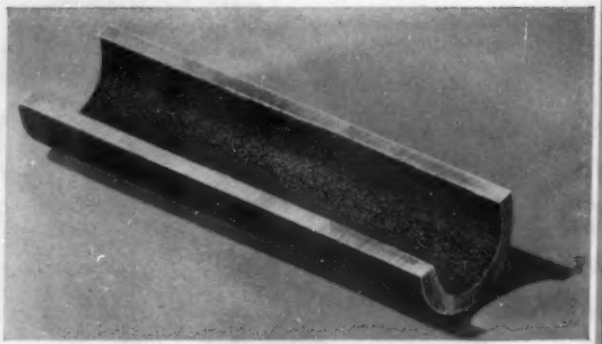


A typical power plant served by Dearborn.



Dearborn 659*, pumped continuously to deaerating heater, keeps this boiler clean.

* Pat. No. RE-23085



Dearborn Filmeen**, a filming type amine treatment, protects return lines against both oxygen and carbon dioxide corrosion.

** Pat. No. RE-23614

Dearborn®

A LEADER IN WATER CONDITIONING AND CORROSION CONTROL

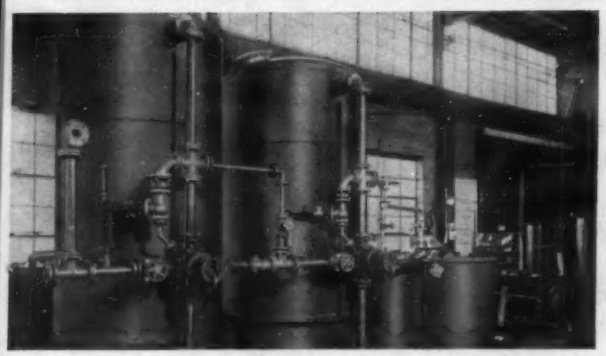
meaning to water treatment

The boiler room of this state institution is a model of efficiency in the generation of power. Here, the constant control of steam purity is the result of a complete water treatment program tailored to meet plant requirements in every respect. Dearborn Supervisory Service brings you the same advantages in the proper treatment of source water to get top results.

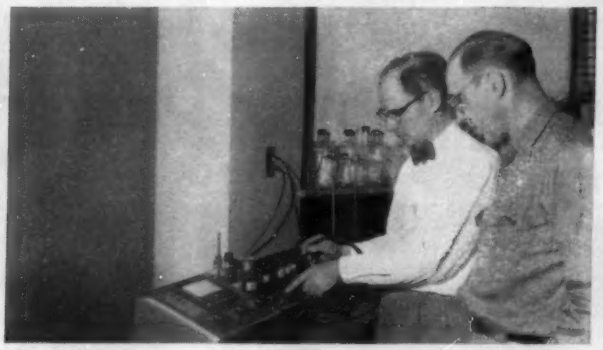
Positive control has been so successfully provided by Dearborn water treatment methods that today, industrial and commercial plants, institutions and utilities are turning to Dearborn for consultation and assistance in—

- ★ **Internal or external feed water treatment**
- ★ **Steam purity control**
- ★ **Feeding, softening or de-ionizing equipment**
- ★ **Cooling water or process water treatment**
- ★ **Water reclamation**
- ★ **Industrial waste treatment**

It may be that this specialized service is just what you need to correct conditions in your power plant. If you will set a time, your Dearborn Water Treatment Engineer will call and explain the many advantages of Dearborn Supervisory Service...a program in which you use only the amount of service you need.



Where mineral-free water is required, a Dearborn de-ionizing plant will reduce the mineral content to the equivalent of that produced by evaporation... and at less cost.



Periodic tests establish continuous quality control so essential in maintaining high steam purity.

mail the coupon

DEARBORN CHEMICAL COMPANY
Merchandise Mart Plaza · Chicago 54, Illinois

Dearborn Chemical Company
Merchandise Mart Plaza, Dept. PG
Chicago 54, Ill.

☐ Please have a Dearborn Engineer call.
☐ Furnish me with more information on Dearborn Water Conditioning Service.

Name..... *Title*.....

Company.....

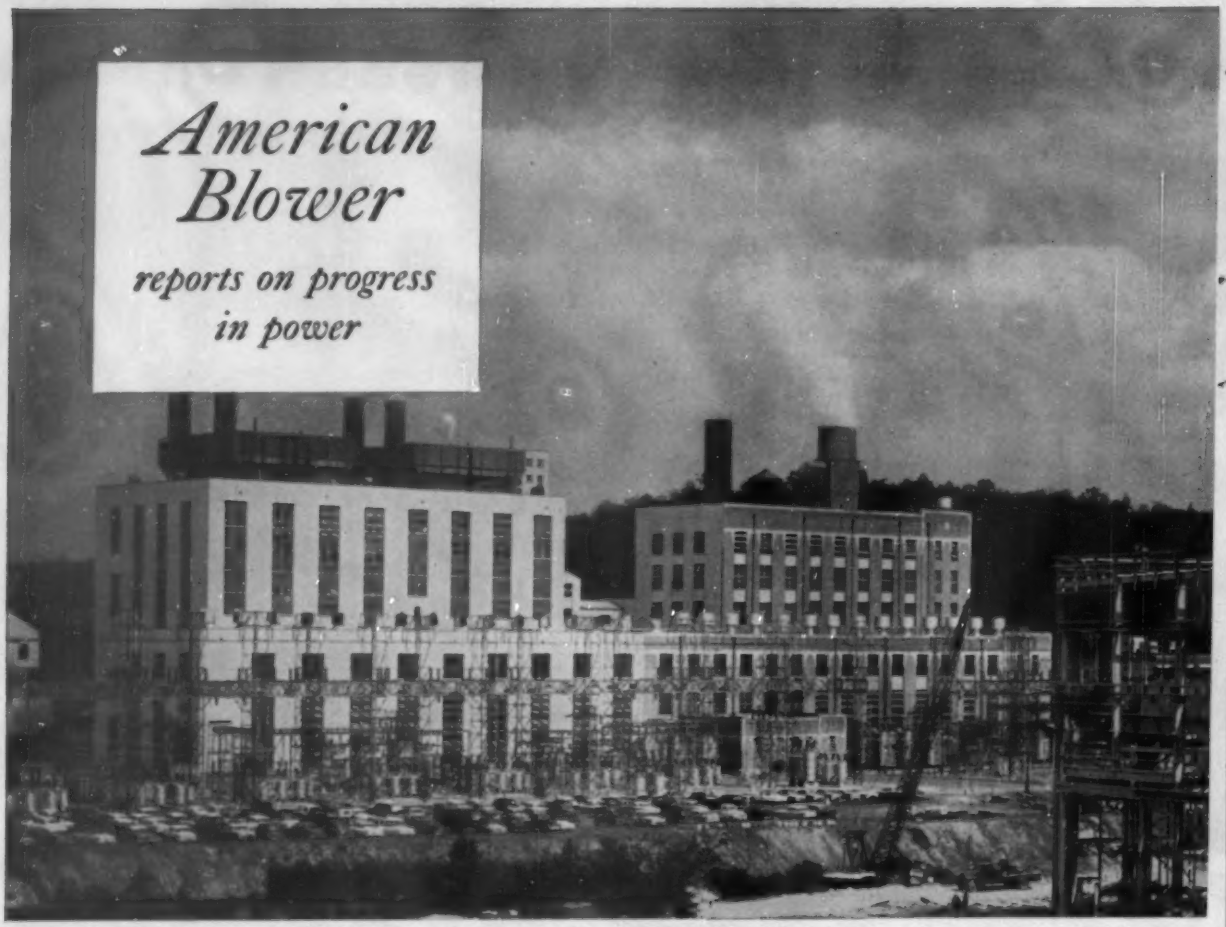
Address.....

City..... *Zone*.... *State*.....

For more data circle 525 on Post Card

American Blower

reports on progress in power



Gorgas Steam Plant No. 2, with 428,000 hp capacity, is on the Warrior River. Plant No. 3 (right), under construction, will house

Alabama Power ups capacity to

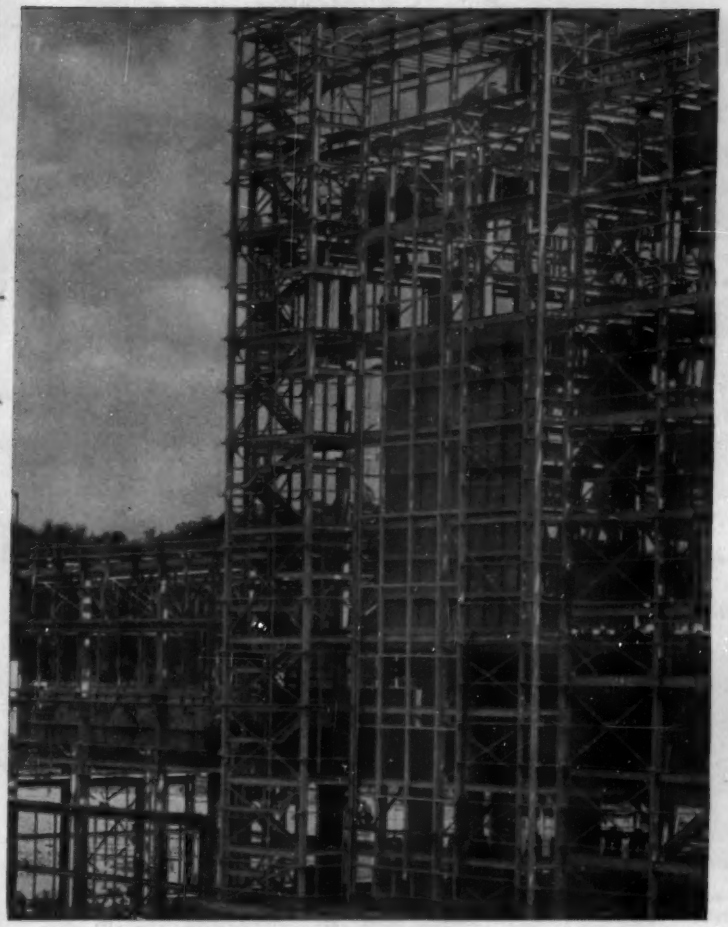
While Gorgas Steam Plant No. 3 is being built, American Blower constructs two Fly Ash Precipitators which will be installed in this new plant. Ratings: 340,000 cfm @ 285° F.

As in the past, Alabama Power installs American Blower equipment—in building for the future

With six steam and six hydroelectric plants, the Alabama Power Company forges ahead for the future of Alabama. In 1955 alone, it will invest more than $35,000,000 in bigger and better electrical facilities, including an eighth generating unit at their Gorgas Steam Plants. When completed this year, Alabama Power's capacity will be over 2,000,000 hp!

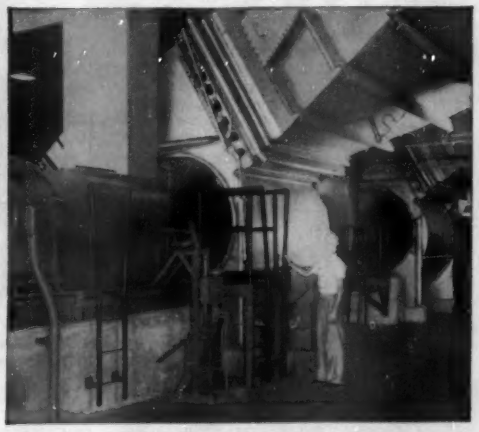
American Blower Forced and Induced Draft Fans, Fly Ash Precipitators and Gyrol Fluid Drives are being installed in this new plant.

From coast to coast you'll find American Blower playing an important role in the expansion and modernization of many other progressive, investor-



No. 8 generating unit, rated at 208,000 hp.

Gorgas Unit No. 7 uses American Blower Fans with Gyrol Fluid Drives. Induced Draft Fans (above) are rated @ 262,500 cfm @ 270° F @ 15.25" sp @ 569 rpm.



American Blower Forced Draft Fans on Unit No. 7 at Alabama Power's Gorgas Steam Plant are capable of 180,000 cfm @ 140° F @ 11.00" sp @ 868 rpm.

over 2,000,000 hp!

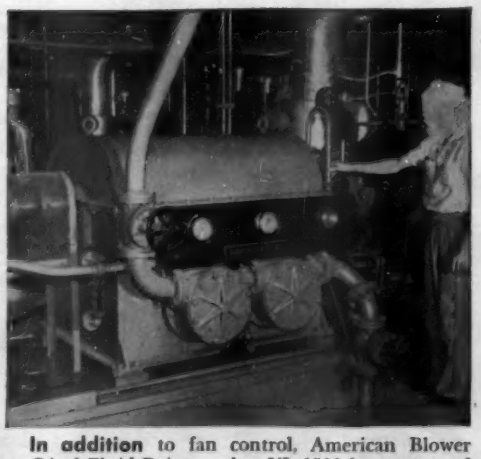
owned utilities. Plant operators have come to rely on American Blower Heavy-Duty Steam Coils and Fly Ash Precipitators, as well as our Mechanical Draft Fans, Dust Collectors, and Gyrol Fluid Drives for boiler-feed pump and fan control.

Give us a call to discuss *your* program. An experienced representative will gladly go over your requirements, and recommend equipment of the highest efficiency and economy. Contact your American Blower or Canadian Sirocco Branch Office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation

AMERICAN BLOWER



In addition to fan control, American Blower Gyrol Fluid Drives — class VI, 1500 hp — are used for adjustable speed control of boiler-feed pumps.

For more data circle 526 on Post Card

EQUIPMENT NEWS

Described on these pages are new and improved products. Use Reader Service Cards on pages 121–122 to ask for more information on them. Just circle the item numbers of all the products in which you are interested.

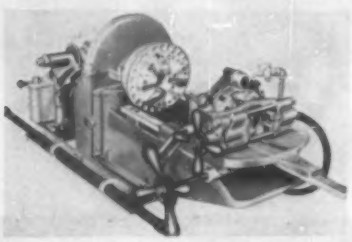
1—SMALL BOILER burns No. 4 oil to save fuel costs

Designed to burn No. 4 oil, this compact 50-hp steam generator enables plants with limited space facilities to cut fuel costs up to 30 per cent, says manufacturer, due to the price differential between No. 4 residual oil and light oils. The tiny boiler is said to operate at efficiencies of 80 per cent or better, and to require less than half the space of many 50-hp units. It can be installed in 20 sq ft of floor area, it is stated, and needs only 4 ft 8¼ in. of headroom. And since no cement foundation is necessary, it can be installed wherever fuel, water and electricity are available.

Multiple installations of this small boiler are expected to prove profitable in metropolitan areas and in plants with wide variations in steam load. It is also suggested for replacing older, larger boilers of lower capacity without expensive structural changes in the plant itself. Cyclotherm Div., National-U. S. Radiator Corp

2—THREADING MACHINE for pipe and bolts

Model-A Pipe and Bolt Threading Machine is claimed to be the fastest of portable pipe machines. According to company, it can thread 2 in. pipe in



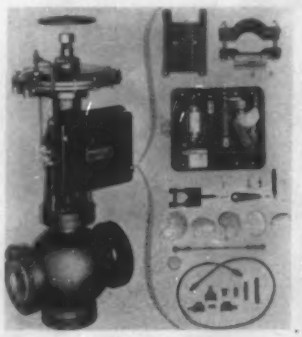
10–12 sec; ½ in. pipe in 5–8 sec. The machine is equipped with a power grip wrenchless chuck which further reduces time required for chucking, compared to former wrench type chucks. It is also claimed that the use of the power grip chuck increases safety of machine operation. Beaver Pipe Tools, Inc.

3—PORTABLE A-C TEST SETS for high potential testing

Newly-redesigned, these 50 kv general purpose a-c test sets are announced as providing smoothly-variable test voltages ranging from 0 to 50,000 v at 5 kva for high potential testing of electrical apparatus and insulating materials. High accuracy is claimed attainable in the range of 15 to 100 per cent of rated voltage. These portable sets are used for testing oil, bushings, insulators and other electrical equipment. The streamlined unit is mounted on a three-wheel truck and has a 15-ft supply cable. It is designed to operate at 60 cycles from a 230 v power supply. General Electric Co.

4—POSITIONER RELAY KIT solves some valve problems

This positioning relay kit is available for field application to any air-operated control valve. Manufacturer claims the relay will solve such major valve positioning problems as stuffing box friction



load, poor response, unbalanced inner valves, hysteresis, and undesirable regulating characteristics. Where control valves are integral with control systems, relay is useful in maintaining stable sensitivity and response, amplifying control signals, and providing sequence operation of two or more valves.

Standard SAMA signal ranges of 3-15 psig or 3-27 psig actuate a force-balance mechanism. As little as 0.065 psig input signal change will apply full output (50 psig max) to valve motor. Relay is direct or reverse acting, suitable for top or bottom-connected valves. Six pre-shaped cams are supplied for square root, linear, square, and half-travel regulating characteristics. Bailey Meter Co.

5—GAGE PROTECTOR has in-line connections

This adjustable gage protector has a a spool-like plunger within a removable cartridge. Connections are in-line, and spring pressure adjustments, or changes of cartridge are made without removing from line. It is designed for use in hydraulic systems with working pressures up to 10,000 psi. Springs are available for standard maximum gage readings from 15 to 5000 psi. Manufacturer explains that when line pressure reaches spring setting, plunger shuts off gage instantly, protecting it from damage; it opens when pressure returns to normal. Entire mechanism is encased in a cartridge which may be removed for servicing. Standard body materials are aluminum and stainless steel, with line port ⅛ in. FPT. Republic Mfg. Co.

6—STEAM TRAPS are economical, high capacity units

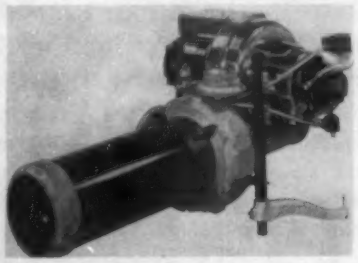
The Thriftrap line of high-capacity, low-cost steam traps are of the inverted bucket type. Four models feature company's Duo-Step Leverage that increases capacity without increasing size of trap body. Traps include such features as cast semi-steel construction, seats and discs of stainless steel and buckets of drawn brass. They are available for pressures to 250 psi and temperatures to 450 F and may be furnished with horizontal or vertical inlet and outlet connections of ½ in. or ¾ in. Catalog Section 601 gives specifications on these traps. The Clark Mfg. Co.

7—VIBRATION ELIMINATOR helps piping stand shocks

Especially designed to meet the special problems of piping systems installed in areas subject to severe seismic disturbances, the No. 10 Type 1B Vibration Eliminators have an overall length of 6 ft. Four springs mounted on a 2⅜ in. rod and parallel to the long axis of the eliminator are provided to absorb two-directional lateral shocks. A pressure of 735 lb per inch of travel is required to compress or expand these springs, says manufacturer. The unit is also swivel mounted to accommodate motion in planes other than that of the vibration eliminator itself. Power Piping and Sprinkler Div., Blaw-Knox Co.

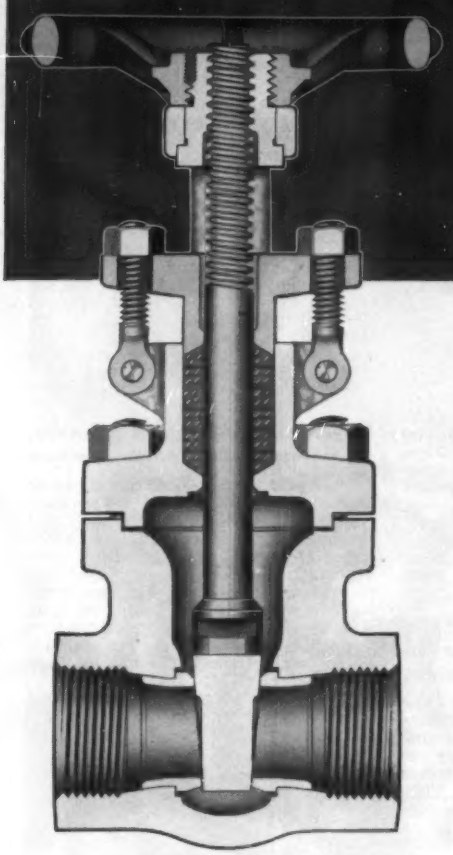
8—FUEL BURNER has unique combustion head

The Cyclonetic Dual Fuel Burner, available in three sizes over a range of from 15 to 92 hp with low pressure gas and light fuel oil, comes as an assembled,



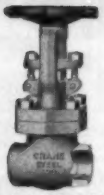
pre-wired and tested package. Burner features a stainless steel combustion head, it is announced, which retains gas flame firmly on outer periphery of a turbulator to assure smooth, quiet operation and to prevent overheating and coking of oil nozzles while burning gas. Standard units include a complete programming electronic combustion safeguard system with both pre-purge and

You get Big Valve quality in these SMALL 600-POUND STEEL GATES by CRANE

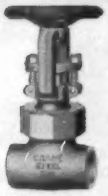


BOLTED BONNET OR UNION BONNET

In the cross-section of the bolted bonnet pattern above, you can see the rugged *big-valve* construction. Bolted bonnet valves available in sizes ½ to 2-inch—union bonnet valves in sizes ¼ to 2-inch.



Screwed Ends—Union Bonnet or Bolted Bonnet



Socket-Welding Ends—Bolted Bonnet or Union Bonnet

Flanged Ends—Bolted Bonnet only

Look no further for dependable steel valves in sizes up to 2-inch. Whether you prefer the union bonnet or bolted bonnet pattern, you get refinements usually found only in larger, more expensive valves.

For example, you get a compact, weight-saving structure of high-quality carbon steel. Smooth operation and positive closure of the solid wedge disc are assured by a T-head disc-stem connection and full-length machined guide ribs. There's also an unusually large stuffing box filled with high-grade packing, a leakproof bonnet joint with retained gasket, a husky stem with outside threads, and many others. To simplify maintenance, Crane design includes swinging gland eye-bolts—plus a wide yoke with liberal working space around the gland.

USER'S CHOICE OF TRIM

There's versatility to these quality Crane steel valves, too. You can have your choice of trim to suit your service—Class X Trim (Exelloy body and body seat rings) for oil or oil vapor—Class XW Trim (Exelloy seat rings, disc of hardened stainless steel) for steam or water. Union bonnet valves also available with Class L Trim (18-8 Mo Alloy seats, disc, stem) for liquids and gases up to 750° F.

Full details in 6-page folder AD-1881. Ask your Crane Representative next time he calls, or write direct.

THE BETTER QUALITY... BIGGER VALUE LINE... IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

For more data circle 527 on Post Card

post-purge by forced draft blower. Special circuitry is available to satisfy local codes. Series B11 bulletins give engineering data. The Webster Engineering Co.

9—33⅓ KVAR CAPACITOR for power factor correction

This high-voltage power capacitor is offered to meet the demand for larger concentrated blocks of reactive kva at lower weight and cost levels. Only 10 per cent heavier than many types of capacitors, this 33⅓ kvar unit is designed to provide over 30 per cent additional corrective kvar. It will provide 300 kvar with nine units instead of the usual twelve 25 kvar units, company points out; or twelve 33⅓ kvar units will expand pole mounted installations to 400 kvar blocks. Economy is another advantage cited by manufacturer, as it is estimated this capacitor will result in more than 10 per cent savings in cost per kvar. Cornell-Dubilier Electric Corp.

10—PRESSURE GAGES, with 5-in. scales, are compact in size

Minified Gages are straight line pointer gages with dimensions about half those of company's standard gages. They are designed to measure pressure, vacuum or differential pressure. Included in the

line are receiver type gages for use with pneumatic transmitters. Minified Gages are intended for use on compact console, graphic or other panels where space is limited. They have all the features of the standard size gage — non-parallax pointers, everlasting translucent glass scales of 5 in. length with draft designations, and internal illumination to increase visibility. Individual elements removable. The Ellison Draft Gage Co.

12—MOTOR features inert gas-filled enclosure

This line of totally-enclosed, inert gas-filled motors in a wide range of ratings is announced for safe operation in hazardous gas-contaminated areas. Enclosures utilize air-to-water surface heat exchangers to remove heat of motor losses. They differ from water-cooled machines in that provision is made for maintaining an inert-gaseous atmosphere within enclosure. It is explained that under positive pressure, non-explosive gas inside motor keeps out volatile ambient gases that could cause an explosion.

To keep gas replacement at a minimum, inert gas-filled stator yokes are constructed of plate steel with gas-tight welds at joints. Seals on shaft extensions are provided to prevent gas leakage outward along the shaft. A gas pressurizing manifold is used to maintain positive pressure within the housing. Inert gas-filled enclosures are favored, company points out, in applications requiring motors of considerable internal volume. Motors are rated 3000 hp, 2300 v, 1800 rpm. Allis-Chalmers Mfg. Co.

13—SPLICING TAPE for use on ozone-resistant cables

The No. 30 High Voltage Splicing Tape is said to incorporate all of the features believed desirable for the new ozone resistant power cables operating at higher conductor temperature ratings of 85 C up to and including the 15,000 v range. The tape satisfies requirements for a splicing tape that will fuse into a homogeneous moisture-proof wall which equals or betters original insulation, company states, filling the gap where other splicing tapes are no longer suitable. It is recommended for use on all cables insulated with ozone-resistant compounds and operating at 2000 v or more. It is said to have superior resistance to erosive action of both corona and ozone, as well as superior aging properties. Bishop Mfg. Corp.

14—FLUID DRIVES are enclosed, self-contained units

Type VS Class 2 Gyrol Fluid Drives are announced as featuring stepless speed control, no-load starting and excellent torque limiting control for smooth transmission of power. They are available for a wide range of speed adjustment on both variable and constant torque loads. The units are designed for dual rotation — drive and load can be reversed while in motion by merely reversing input rotation when used with an electric motor.

According to company, this type of drive lets the motor come up to speed under practically no-load conditions, and this allows simplification of motors and starting equipment for heavy loads. Across-the-line starting is declared practical in many cases. The drive units will limit the amount of overload torque which can be transmitted to the load. Torque transmitting capacity is adjusted by positioning the speed control lever, and rate of movement of the same lever governs acceleration rate. The drive is adaptable to manual or automatic control. It is available in sizes from 7½ to 800 hp for speeds to 1800 rpm. American Blower Corp.

15—HOSE CLAMP goes on easily, has good clamping action

This general purpose hose clamp can be fixed in place in 3 sec with an ordinary pincers, manufacturer announces, and lasting clamping action is assured under extreme internal hose pressure, hose movement and tough usage. The one-piece clamp is suggested for lines carrying compressed air, oxygen, hydrogen, acetylene, insecticides, chemicals, water, steam, acids, gasoline, oil. The clamp is round with U-shaped folds or lugs.

Smaller size models have two lugs and the larger ones three. You merely slip the clamp on the hose or part, and crimp it in place by squeezing the parallel sides of the lugs together with the pincers.

According to company, there is no danger of the pincers slipping. To remove the clamp, you snip off the lugs with the pincers. Initial low cost of the clamp makes replacement economical, it is stated. The clamp comes in ferrous and non-ferrous metals, in 20 sizes from ¼- to 2⅝-in. ID. Larger sizes can be produced. Circle Clamp Corp.

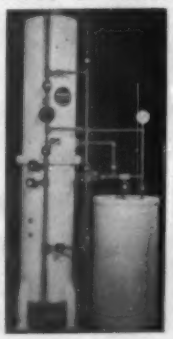
16—UNIT HEATERS are self-contained, gas fired

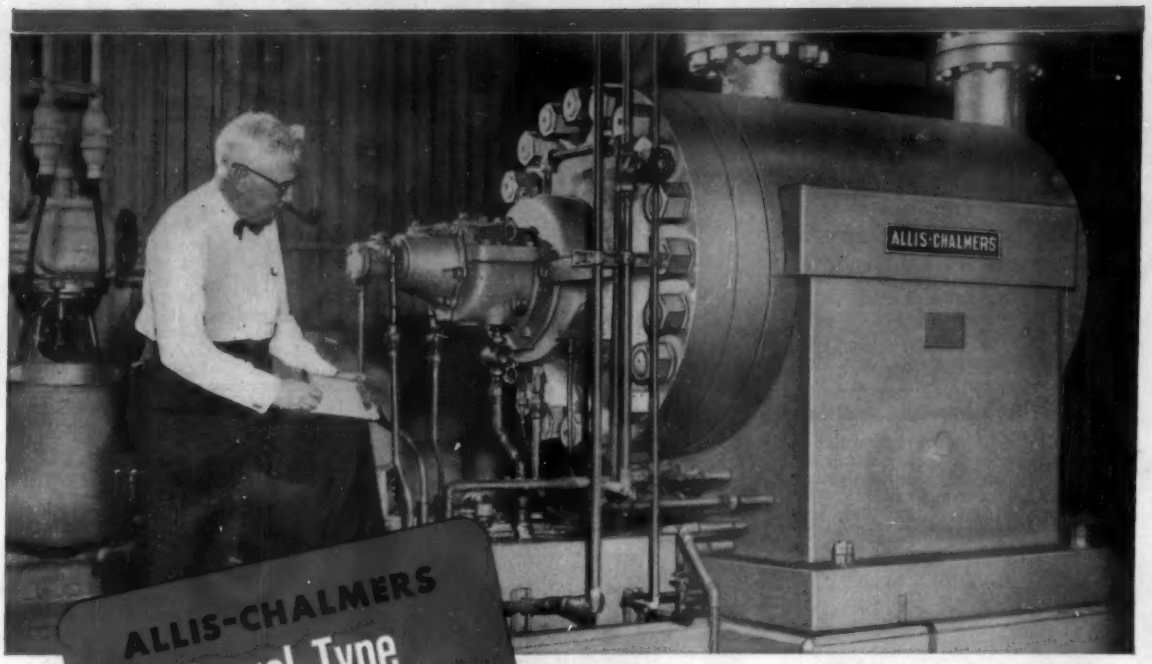
These ceiling suspended, downward discharge heaters are self-contained heating units combining gas burners, combustion chamber and heat exchanger with motor driven fan and fixed or revolving discharge outlets. Combustion chamber

11—MIXED-BED DEMINERALIZER for smaller quantities of water

For demineralizing up to 360 gph of water the compact Model MBD-15 contains a resin bed consisting of an intimate mixture of cation exchanger, Permutit Q, and strongly basic anion exchanger, Permutit S. It is designed to produce a water of low total dissolved solids, low CO_2, low silica content and low conductivity. Manufacturer claims that the treated effluent from this unit will have an average conductivity of 0.15 micromhos, equivalent to approximately 6,000,000 ohms-cm specific resistance or 0.05 ppm total electrolyte content; also that carbon dioxide will be reduced to 0 to 1 ppm and the silica to about 0.1 ppm.

Flow rate of the Model MBD-15 Demineralizer is 6 gpm average to 7.5 gpm maximum. It has a kilograin capacity of 24,000 grains total dissolved solids and treats 4100 gal of raw water containing 100 ppm total electrolytes. When the unit is exhausted, the resin bed is regenerated with 12 lb of sulfuric acid for the cation exchanger and 20 lb of caustic soda for the anion exchanger. The Permutit Co.





ALLIS-CHALMERS
Barrel-Type
BOILER FEED PUMPS

In the Dallas Steam Electric Station

OF THE DALLAS POWER & LIGHT COMPANY

What Are Your Pump Needs?

Whether you require boiler feed, condensate, circulating or other power plant pumps — a careful study will reveal why more and more utilities are specifying Allis-Chalmers. Check the design features, the operating advantages, the provisions that make a pump easier to maintain, or service. You, too, will find it pays to standardize on Allis-Chalmers Power Plant Pumps.

Complete Unit from One Source

Allis-Chalmers can supply the complete pumping unit—pump, motor and control—of coordinated design and manufacture. You get one responsibility—one guarantee of satisfaction.

Get complete information on Allis-Chalmers barrel-type boiler feed pumps. Call your Allis-Chalmers District Office or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 08B7899.

Here Are Important Features that Keep Operating Costs Low:

- First stage has twin, single-suction impellers to give low NPSH requirement for highest efficiency under fluctuating loads.
- Impellers, mounted back to back, balance axial forces without use of balancing drum.
- Double volute casing maintains radial balance under fluctuating load.
- Expansion joint and shaft seals are brought to outside of pump where they may be inspected often and worked on easily, if required.

A-4790

ALLIS-CHALMERS

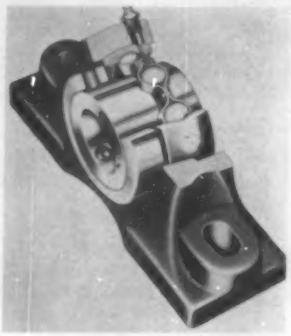
For more data circle 528 on Post Card

and heat exchanger are of 16-gage aluminized steel, welded into a one-piece assembly. Burners are cast iron. A built-in draft diverter is provided to assure proper burner operation under abnormal conditions of back draft, and there are automatic safety controls. First size in the present line has an input capacity of 430,000 Btu per hour.

Heaters have discharge outlets to suit the installation requirements of ceiling height and floor area. Revolving discharge outlets send heat downward in a gently moving stream that covers the entire working area, says manufacturer, and this same circular motion provides cooling during the summer. L. J. Wing Mfg. Co.

17—BALL BEARINGS for medium duty service conditions

SCM Ball Bearings are announced as incorporating all features of company's present SC series in addition to providing more load carrying capacity. They are also available in larger shaft sizes. The new line includes both ball bearing pillow blocks and ball bearing flange



cartridge mounts. According to manufacturer, the rugged semi-steel outer housing affords greater strength with a trim, streamlined appearance; and full self-alignment is provided by the spherical outer race of the ball bearing inner unit which fits into the spherical seat in the housing.

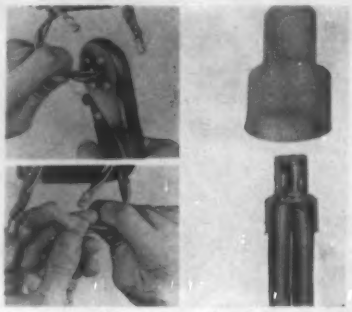
Metallic-backed synthetic seals are mechanically anchored in position and will not blow under grease gun pressure, it is noted, and the lubricant is sealed in. A locking pin is used to prevent rotation of outer bearing race while allowing self alignment. SCM Ball Bearings come fully assembled, pre-lubricated and ready to mount on the shaft. The bearing is locked to the shaft by two set screws. Dodge Mfg. Corp.

18—INDUCTOR MOTOR, slow-speed, synchronous type

The SMY line of synchronous inductor motors, it is announced, features slow-speed synchronous operation, instantaneous acceleration and deceleration, and instantaneous reversing. Motors are designed for applications requiring moderately high torque at low speeds, synchronous speed operation, or rapid deceleration or reversing. They are available in torque ratings of 75- and 2-oz-in. at 60, 50, and 25 cycles. Typical installations where SMY motors would be useful, according to company, are remote-operated recording devices, and control and feed motors. Synchronous characteristics are used by industrial process timers, since sufficient torque is developed to operate cams and levers, eliminating need for a second motor or solenoid. Low speed and rapid deceleration also make motor suitable for certain jobs which previously required either a gear-motor, brake motor, or both. General Electric Co.

19—NYLON INSULATOR goes on fast and easily

This nylon splice-cap insulator features ease, speed and simplicity of installation, it is announced, and provides excellent electrical and mechanical protection to spliced joints. Its snap-on-



lock design is said to assure factory perfect insulation of wire splices and makes it easy to install, even on flexible wires and in extremely hot or cold weather. Construction eliminates threading, wrapping, or twisting of insulator during installation and possibility of loosening in service, company points out — even under extreme vibration. Translucent nylon body permits inspection of completed splice. Insulators are available in two sizes for use with company's splice caps which splice normal circuit wiring from two No. 18's through three No. 8's or two 6's. They are announced as UL approved for building wire to 600 v and in fixtures to 1000 v, in applications to 105 C. Buchanan Electrical Products Corp.

20—INSTRUMENT VARIATIONS for level and flow control use

Three variations are announced for this company's Tektor, an electronic level and flow detector and controller: the tube-in-probe Tektor; differential Tektor; and time delay Tektor. The tube-in-probe Tektor was developed to provide greater accuracy in controlling levels of substances having low electrical conductivity, or in interface applications where materials are of similar dielectric constant. This model has additional circuitry, housed in an explosion-proof condulet and integrally mounted with the sensing probe. It is explained that the nearness of the additional circuitry to the sensing element affords control within closer tolerances, and permits use of any length of conductor cable between probe and control box.

The differential Tektor offers one instrument level control in vessels where a definite differential must be maintained between high and low points. It is suggested for situations in which the span between high and low levels is about 5 ft. A vertically mounted sensing probe, permitting differential to be changed at a time, or two shorter probes, marking extremes of the span, may be used. Manufacturer cautions that this instrument must be used only in situations where cycle of rising and falling is completed continuously, as this is required to operate the controls properly.

The time delay Tektor was designed to control flow of material delivered in clumps, waves or generally erratic. To bridge interruptions in flow or level, an electronic time delay mechanism, adjustable up to 15 sec, is built in. This allows the succeeding wave material sufficient time to reach the sensing probe without causing the instrument to "trigger," it is stated, and avoids convulsive "start and stop" performance of control pumps, motors, etc., and eliminates "relay chatter" of such equipment. Fielden Instrument Div., Robertshaw-Fulton Controls Co.

21—SOLDERING FLUX, self-cleaning; comes in 2 oz cans

For those with only occasional use for soldering flux, La-Co Flux (Regular) is made available in 2-oz cans. Described as a non-acid, self cleansing flux, this product can be used with 40-60, 50-50, 60-40, 95-5 solders. Company says this flux automatically prepares the metal for instant alloying with the solder because the flux, when heated, flows by capillary action through surface oil film and disperses any metal oxides present. It flows into otherwise inaccessible places, even uphill, it is claimed; yet the attraction of the solder for metal forces the flux from the metal, leaving no residue.

According to manufacturer, no sanding or wire brushing is necessary with La-Co Flux, and it won't harm the user or his clothing — or stain or pit metals. It is declared safe for use on oxygen pipes and containers used in food processing. Lake Chemical Co.

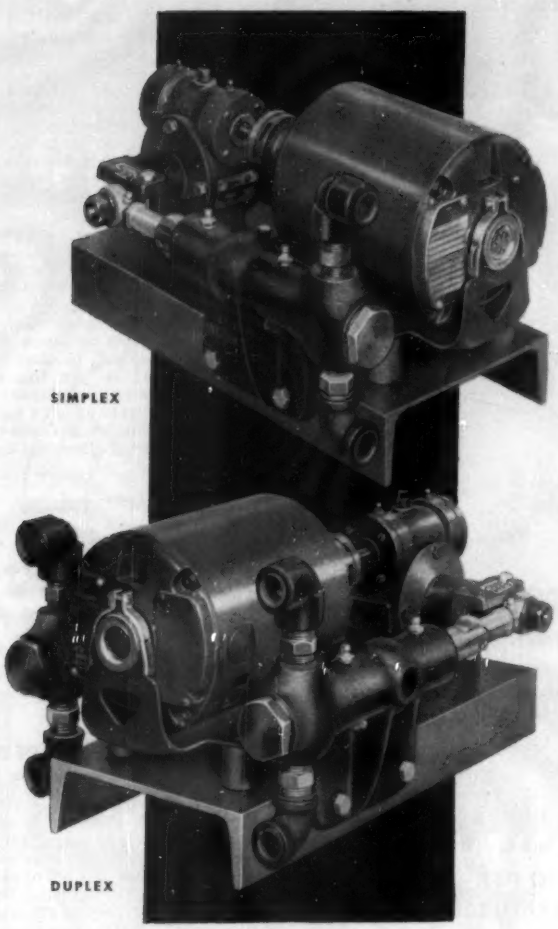
22—PLASTIC CABLE CLAMPS reinforced for extra strength

Announced as non-corrosive, extra strong, fire resistant, and affording excellent insulation, these new cable clamps are offered for applications where vibration and shock are important factors.

Among other advantages claimed for the clamps are ability to withstand high temperatures, abrasion resistance, ease of installation and less danger of short circuit and fire, because the plastic clamps do not promote contact. The clamps come in size numbers from 2 through 32, and in cable diameters from ⅛ through 2 in. Lunn Laminates, Inc.

23—FLOCCULATING AGENT for disposal, recovery jobs

Good-rite K-720 is a synthetic resin flocculating agent for use in disposal



Proved! Low cost!

Milton Roy Controlled Volume

H-20 PUMPS

for accurate, dependable water-treating service

THE Milton Roy H-20 Controlled Volume Pump provides simple, inexpensive chemical metering for treatment of boiler water and for other general purpose water and waste treatment systems. H-20 Simplex and Duplex units offer repeatable metering accuracy plus extra economies, from low first cost . . . through installation and operation.

Liquid end design employs double ball-check valves in a vertical column. Packing is spring loaded from the front end. Both valves and packing are simple and inexpensive to replace.

Standard drive is by constant speed ⅓ hp electric motor. Variable speed, three-phase, totally enclosed, or explosion-proof motors are also available.

Capacity regulation is easily accomplished manually or automatically.

Conversion from Simplex to Duplex, or vice versa, can be done in the field.

Standard models are available in stock for immediate delivery. Capacities to 28 gph (Simplex). Pressures to 600 psi.

Hydrazine addition . . . other advanced techniques

Where Hydrazine is used to scavenge residual oxygen, precise feeding of the chemical is required to maintain oxygen content at zero. This is a job demanding controlled volume pump precision.

For detailed technical discussion of "*Controlled Volume Pumps For Water Treating Systems*," send for Bulletin 963. Just off press, this 24-page bulletin contains clear text, illustrations, and diagrams on all the latest applications, including Hydrazine addition to boiler feedwater.

Engineering representatives in the United States, Canada, Mexico, Europe, Asia, South America, and Africa.

FOR DETAILS
send for Bulletin H20-1.
Milton Roy Company,
Manufacturing Engineers,
1300 E. Mermaid Lane,
Phila. 18, Pa.

milton Roy
CHEMICAL FEED SYSTEMS

For more data circle 529 on Post Card

CARBON STEEL

R-P&C Bar Stock Valves

• RATED FOR 10,000 PSI

• FOR CLOSE CONTROL, HIGH TEMPERATURES OR PRESSURES

These rugged bar stock valves were originally developed by R-P&C for close control or instrument use. However, their versatility has proven itself in so many different applications that they are now considered general purpose valves. They are particularly applicable for services involving throttling, or high temperatures and pressures, and are especially adapted for use in crowded applications such as panel boards.

Rated for 10,000 psi at 150°F., each carbon steel bar stock valve is individually tested at 15,000 psi before leaving the factory. They are supplied in sizes from ¼ to 1", in globe and angle styles with female ends, male and female ends, or male union ends. They can be furnished in 12-14 chromium stainless steel and 18-8 molybdenum stainless steel for corrosive applications. May also be supplied with special stellite discs for extra abrasion resistance in extremely severe throttling services. Those other than carbon steel are rated at 4,000 psi at 150°F.

FREE WALL CHART

"How to Protect Your Valves"
17 x 22" wall chart gives installation and operation pointers. Tells how to protect valves, prolong life. Write for your copy.

R-P&C's complete selection of bar stock valves is only one element in a complete valve line which includes gate, globe, angle and check valves in a wide range of sizes and styles, in bronze, iron and cast and forged steel. *See your R-P&C Distributor or write for catalog.*

ACCO

R-P&C Valve Division
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

R-P&C valves

For more data circle 530 on Post Card

or recovery operations involving clarification, sedimentation, or filtration. It serves to collect small solid particles into large clusters. The formation of clusters, or floc, facilitates separation of dispersed solids from the liquid. The material improves the degree and rate of sedimentation while improving the filtration rate characteristics of dispersed solids, it is explained; and in filtration, flocculation with K-720 forms a more porous filter cake with resultant reduced pressure drop and increased throughput. Efficient washing of the filter cake is more easily accomplished.

K-720 is claimed outstanding in systems involving organic matter, as in the paper and sugar industries. And its benefits are achieved economically, it is pointed out, because treatment as low as 0.01 lb per ton of dispersed solids is normally sufficient. (The resin is also available as a 20 per cent water solution identified as Good-rite K-720S.) B. F. Goodrich Chemical Co.

Reader Service Cards on pages 121–122 make it easy to get further information on any of these products. Just circle the item numbers of the products you want to know more about.

24—VARIABLE SPEED PULLEY
needs no lubrication

This low cost ¾-hp variable speed pulley, it is announced, can be readily adapted to new or existing equipment. Initial economy has been effected by use of a minimum number of parts, company points out, yet essential features necessary for delivery of efficient power and smoothness of operation have been retained. Simplicity of design also reduces upkeep and maintenance, it is noted, and use of oil-impregnated bronze bearings eliminates need for lubrication.

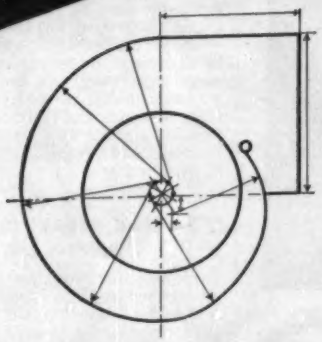
Pulley delivers a speed ratio to 2¾ to 1, using an A section belt. Maximum bore is ⅞ in. with keyway. Shaft bore runs through entire length of pulley, giving added advantage of reverse mounting when necessary. Company points out that the spring cover has been eliminated, since pulley is usually used in enclosed portion of machinery. Extremely compact, the entire unit measures 4 13/16 in. long and 6 in. diam. Weight of the pulley is 6½ lb. Lovejoy Flexible Coupling Co.

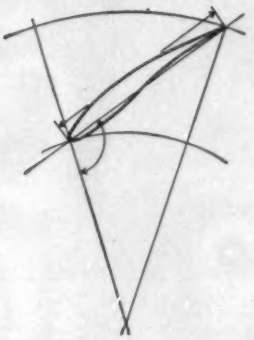
25—CURRENT TRANSFORMERS
for outdoor use

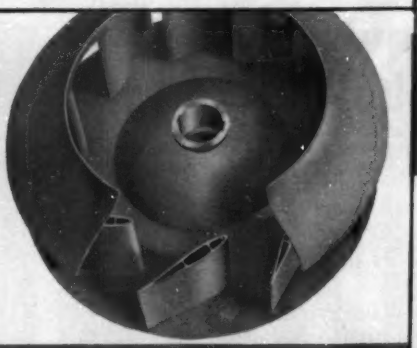
Types EMR and EMO polyester-molded outdoor current transformers, designed for 600-v service, are announced as having 0.3 accuracy with B-0.1 and B-0.2 burdens, and having a rating factor of 2. Type EMR, having a round primary opening, is supplied in 200/5- and 400/5-amp ratings. EMO, with an obround opening, is supplied in 200/5-, 400/5-, 600/5- and 800/5-amp ratings. Both units are available with or without silver-plated, flat-terminal primary bars, 11¾ in. long. A round primary bar, 10½ in. long, is supplied only with Type EMR.

A polyester elastomer insulating ma-

GREEN *Airfoil type* DRAFT FAN







✱ 6 DIFFERENT DESIGNS

✱ MANY VOLUME-PRESSURE COMBINATIONS

Thus you can obtain from Green not only the modernized 1955 version of the AIRFOIL Type of Fan made by us back during the World War 1 era but you can probably get much closer to your actual draft requirements *at high guaranteed efficiencies* than with other types of fans.

Six different designs provide a dozen combinations of diameter, width, shroud angle, blade angle, blade length and other influencing factors. You will be getting exactly what you need in the way of volume, pressure, and speed at the most efficient point.

When writing for complete details of the modernized redesigned line of Green GALEX AIRFOIL Type Draft Fans, tell us as much about your requirements as you can disclose at this time. It will help us to choose the best GALEX Fan for your anticipated draft problem.

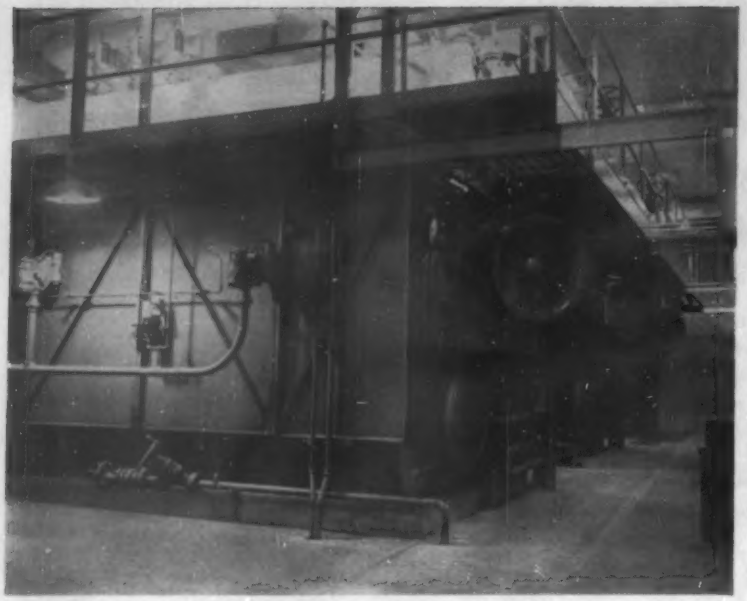
GREEN *THE AIRFOIL TYPE FAN* Galex FAN

GREEN POWER AND PROCESS PLANT EQUIPMENT

FUEL ECONOMIZER COMPANY,

BEACON 3, NEW YORK

For more data circle 531 on Post Card



Here are three Bros Packaged Watertube Boilers on the line at the Bell Aircraft, Kenmore, N. Y., plant. Steam generated is used primarily for heat, some for processing. Maximum load is 28,000 lbs. of steam per hour at 50 lbs. pressure during winter months.

Solve steam problems quickly with BROS packaged boilers

● If you are planning a new plant . . . expanding . . . or replacing an old system, find out about the new Bros Packaged Boiler. Bros offers a compact, highly efficient unit, completely factory assembled and ready for simple service connections at the building site. The packaged units are primarily for medium loads; however, in multiples they replace the larger custom units and in so doing eliminate great expense.

No extended work interruptions or erection problems are encountered when you install a Bros Packaged Boiler. It can be lifted or skidded into place. Costly foundations and accessories are not required.

Bros Packaged Boiler capacities run from 4,100 to 30,000 lbs. of steam per hour with design pressures up to 600 psi. Available with or without burning equipment, oil and/or gas. Choice of manual, semi-automatic or fully automatic controls.

WRITE FOR YOUR PERSONAL COPY OF THIS NEW CATALOG

This colorful catalog contains design features, construction details, drawings and specifications of Types W-1, W-2 and W-3 Bros Packaged Boilers. Get your copy for reference or file now!

***POWER DIVISION*— WM. BROS BOILER & MFG. CO.**

1057 Tenth Avenue S.E. BROS Minneapolis 14, Minnesota

DESIGNERS AND MANUFACTURERS OF WATERTUBE BOILERS, 2-3-4 DRUM AND PACKAGED DESIGNS, AUXILIARY EQUIPMENT, AND A FULL LINE OF INDUSTRIAL STOKERS.

For more data circle 532 on Post Card

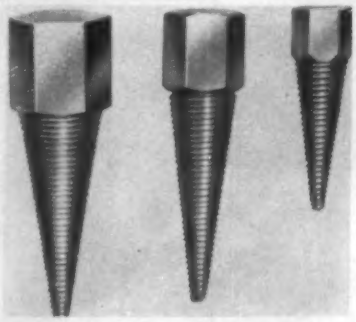
terial used on both types is molded to core-coil assemblies, and weather-resistant secondary covers with provisions for meter seals are provided. The Hypersil core makes both types small in size in relation to their ratings. Type EMR has a stainless steel mounting base; Type EMO, a hard-rolled aluminum base. Bases for both can be rotated 90 deg for mounting flexibility. Westinghouse Electric Corp.

26—UNIT HEATERS, blower type with wide range of capacities

Available in 170 ratings from 125,000 to 1,500,000 Btu — 1430 to 20,800 cfm — these blower type unit heaters can be floor, wall or ceiling mounted. Company says they can be used with or without ducts, with by-pass damper, filter section and mixing dampers to handle almost any space or process heating and ventilating requirement. C. A. Dunham Co.

27—LEAK REPAIR PLUGS for repairing gas lines, tanks

Designed for making permanent or emergency repairs in gas lines, tanks, and boilers, these repair plugs are made in a variety of sizes of heat treated



alloy steel. According to manufacturer, the plugs take the strain of thread cutting themselves into a hole to seal the break. For permanent repair or to reinforce weak metal, welding around the plug is advised. A sample repair plug is available to qualified power engineers. R. H. Baker & Co., Inc.

28—PROTECTIVE COATING guards against corrosion

Corrocote 362 is a Neoprene base coating for protection against moisture, oils, chemical fume and splash, salt air and fungus corrosion. Applied by roller, brush, spray or dip, the film dries quickly and self-vulcanizes to form a firm, rubbery barrier, says company, and it lasts a long time without losing its protective ability. Addition of other agents to obtain elasticity isn't required, it is pointed out.

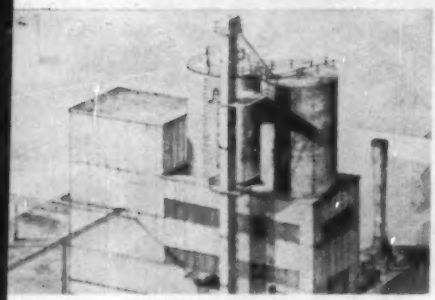
The cured film is claimed to resist abrasion, sunlight and weather, to counteract electrolytic corrosion, and to be a non-conductor. Reported to have good adhesion to metal, concrete, wood and fabric, the coating can be exposed to continuous temperatures to 250 F, intermittent temperatures of 300 F. When sprinkled with sand while wet, Corrocote offers a non-slip walking surface. It comes in black, aluminum and red.

DUPONT'S Barksdale, Wis. Works saves $7,000 a year with new automatic combustion controls.

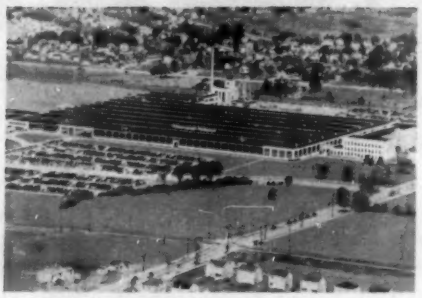
HUDSON MOTORS' modernized plant in Detroit saves $480,000 a year—cuts powerhouse labor 27%.

SYRACUSE UNIVERSITY, N. Y., built a completely new unit for maximum economy and dependability.

For efficiency...for economy...



AT STAUFFER CHEMICAL'S new plant in Louisville, Ky., total cost of steam is only 60¢ per 1,000 lbs.

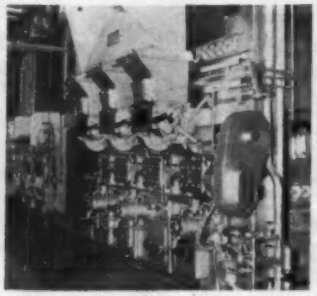


Coal costs 29.6% less than next cheapest fuel at ADDRESSOGRAPH-MULTIGRAPH'S plant in Cleveland.

MOTOR PRODUCTS CORP. of Detroit, Michigan, saves $54,000 a year with modernized installation.

more and more firms

Burning coal the modern way saves PENNSYLVANIA RAILROAD'S, Ft. Wayne, Ind. terminal $33,000 a year.



Efficient new equipment reduces labor and improves performance records for LIGGETT & MYERS at Richmond, Va.

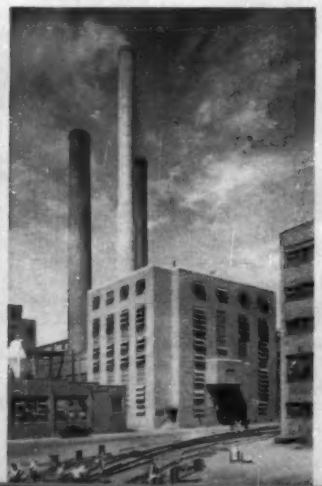
At LAKEWOOD HOSPITAL, in Lakewood, Ohio, new automatic coal burning facilities cut fuel costs 22%.

UPJOHN'S new Kalamazoo, Mich. plant is clean and efficient with no dust or smoke nuisances.

are burning coal the modern way

Chicago's ultra-modern PRUDENTIAL BUILDING has fully automatic coal handling and burning system.

GOODYEAR saves $3,000 a day with new coal-burning installation at Akron, Ohio.



facts you should know about coal

- In most industrial areas, bituminous coal is the lowest-cost fuel available.
- Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar.
- Automatic coal and ash handling systems can cut your labor cost to a minimum.
- Coal is the safest fuel to store and use. No dust or smoke problems when coal is burned with modern equipment.
- Between America's vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and its price remaining stable.

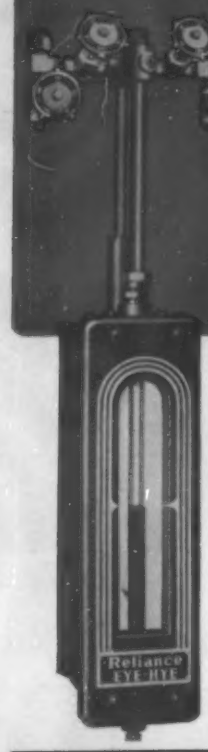
For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

NATIONAL COAL ASSOCIATION
Southern Building, Washington 5, D. C.

Check your boiler water levels with the completely hydrostatic Reliance

EYE-HYE

Remote Reading Gage



Simple as A-B-C, yet accurate, safe, dependable

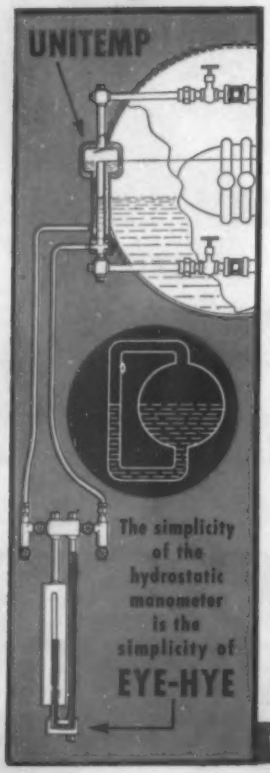
Make your boilers and power plant safer from water level failure. Use an EYE-HYE on each boiler. Engineers can't miss seeing this reliable, accurate device that carries water level reading to panel or convenient wall position.

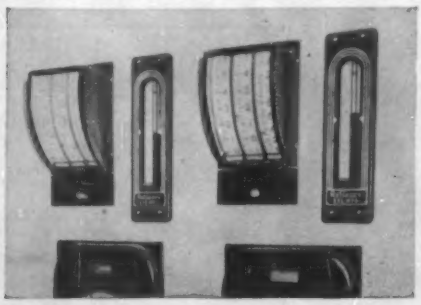
Simplicity is the secret of EYE-HYE's dependable full-range accuracy — all hydrostatic operation, no mechanical working parts. Factory-calibrated to your water level range and working steam pressure — cannot be tampered with. Nothing to adjust during installation. Easy to install, practically no maintenance. Complete "Unitemp" temperature equalizing unit is furnished with each EYE-HYE.

Reliance EYE-HYE is a familiar sight in thousands of power plants. Models for any remote gage need — any pressure. Write the factory or nearest Reliance Representative for Bulletin CO.

The Reliance Gauge Column Company

5902 Carnegie Avenue • Cleveland 3, Ohio





Reliance®

BOILER SAFETY DEVICES

Uses include exteriors of pipes, tanks, ducts, structural steel. It may also be used for conveyor belt repair, on power transmission shafts, valve parts, electrical switch and terminal housings. Chemical Coatings & Engineering Co.

29—FRICTION CLUTCH features gradual pickup

This improved friction clutch is said to be especially suited for power transmission applications where increased speeds prohibit use of jaw clutches and where gradual pickup is a requisite. It features the "over-the-center" toggle mechanism in its design, to provide positive positioning and minimize possibility of accidental engagements or disengagements.

It also allows drag-free idling. Large friction areas give higher torque capacity in relation to size, it is pointed out, and heat dissipation is high, because friction surfaces are substantial castings directly cooled by air.

This clutch, with capacities up to 170 hp at typical industrial speeds, is available in three types: clutch with mounting sleeve, for use on applications where it is desirable to mount sprockets, gears, pulleys or other power transmission equipment on the sleeve; clutch with mounting ring, which provides for mounting drums, sprockets, pulleys, or sleeves directly to gear ring of clutch; and clutch coupling, for use in connecting two in-line shafts, permitting smooth engagement and disengagement of drive shaft. Book 2637 gives details on the clutch. Link-Belt Co.

30—POWER GUN speeds machine lubricating jobs

A portable air-operated gun, the Model 711-H is said to save 6 man-hours for every 25 lb pail of lubricant applied, and to be capable of power lubricating any machine. Pumping directly from original 25- or 35-lb pails of lubricant, this gun is designed to deliver up to 14½ oz of lubricant per minute. A 6-ft high pressure hose, Z swivel and control valve afford convenience of operation. Because it develops a pressure ratio of 40 times the air pressure used, the new unit is claimed well suited for smaller shops where lubricants are purchased in smaller quantities.

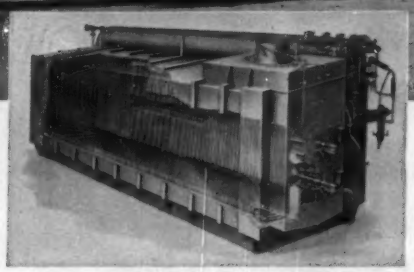
Economies in handling lubricants are realized in that transferring and loading operations are eliminated; a follower plate cleans grease out of the pail, and an easily-applied cover (adjustable to either size pail) keeps out contamination. The unit weighs 12½ lb. Alemite Div., Stewart-Warner Corp.

more Equipment News page 133

For more data circle 534 on Post Card

keeping steam cheap . . .

NEXT "START" Cuba to begin a distinguished career



ANOTHER B&W BOILER EMBARKS FOR FOREIGN SERVICE

Headed toward many years of dependable steam-generating service in a Cuban sugar central, this B&W FM Unit joins the long list of B&W Boilers that are now in service in Cuba—a list that started way back in 1879.

Previously, all boilers were shipped in pieces and assembled at the job sites. Now, FM Units up to 40,000 lb per hr capacity—like this oil-burning unit—are shopbuilt—this one loaded on a car for travel without further handling directly to the job site—there skidded into place, service connections made, and put in operation.

The B&W Type FM Water-Tube Boiler combines the advantages of "packaged" steam with many of the benefits of big boiler design. Large capacity with central-station dependability can be installed in small space. Automatic control, with push-button start and stop and fuel-air ratio control, simplifies operation, readily meets load swings, and provides economical operation over the load range.

The FM's reputation for dependability in service is backed by the resources and boiler-making experience of The Babcock & Wilcox Company . . . one reason why the demand for these versatile units is increasing. Right now, for example, FM Units having a total steam capacity of over 11,000,000 lb per hr are in service and on order for various industries, utilities, institutions, and other users.

The FM is available in standard sizes up to 40,000 lb steam per hr at operating pressures to 235 psi. Many FM Boilers are also in service at higher pressures and, like this Cuban Unit, with moderate superheat.

For complete details about this compact "work-horse," write for Bulletin G-76. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

FM Features for Economy and Efficiency

- Saves Erection Time and Cost
- Meets Wide Range of Service
- Handles Quick Load Changes
- Suitable for Outdoor Service
- Safe, Automatic Operation
- Saves Space
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Burns Oil and/or Gas
- Saves Fuel

BABCOCK & WILCOX

BOILER DIVISION

G-726

For more data circle 535 on Post Card

MUSCLES

HAGAN POWER POSITIONERS IN *FULL* RANGE OF SIZES!

6" x 10" Hagan Power Positioners operating inlet louvers to the forced draft fans for boilers of large power plant. (midwest climate)

10" x 30" counterweighted Hagan Power Positioner for 2500 pound slide type damper.

8" x 25" Hagan Power Positioner operating 54" butterfly valve, controlling flow of blast furnace gas to boiler. (Outdoor installation, note steam tracer lines)

FOR INDUSTRY

Hagan Power Positioners are rendering dependable, accurate service under the most severe operating conditions. These rugged, double acting units assure plenty of power, and are meeting high standards of accuracy for valve, damper and lever operating applications.

Low piston leakage, low piston friction and modest cost make Hagan Precision Positioners an economical buy.

CHECK THESE MANY OUTSTANDING FEATURES:

ACCURATE—piston takes a positive position for every incoming signal. Repeatability—1%.

HIGH SPEED—90% stroke in as little as 1.0 second.

FLEXIBLE—positioning is normally linear with signal pressure, but any desired relationship may be obtained by shaping the feedback cam.

INPUT SIGNAL RANGES—complete selection of ranges—3-15, 0-30, 0-60; others available.

RUGGED CONSTRUCTION—insures dependable, long, trouble-free life.

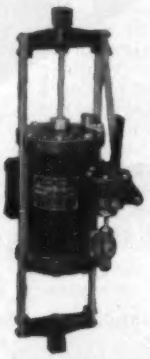
FULL RANGE OF SIZES—4″ to 12″ bore—5″ to 48″ stroke. Full power for any need.

ACCESSORIES—Manual Operators—piston air locks—limit switches and many others.

4" x 5" HAGAN POWER POSITIONER

Stall torque—400 lb ft.*
90% full stroke—1 sec.
Specification Sheet TP-245

*With 100 psi power air



5" x 10" HAGAN POWER POSITIONER

Stall thrust—1950 lbs.*
90% full stroke—1.8 sec.
Specification Sheet TP-1510

8" x 14" HAGAN POWER POSITIONER

Stall torque—4600 lb ft.*
90% full stroke—2.5 sec.
Specification Sheet TP-2814

12" x 48" HAGAN POWER POSITIONER

Stall thrust—11,000 lbs.*
90% full stroke—6 sec.
Specification Sheet TP1100

HAGAN HALL BUROMIN CALGON

HAGAN CORPORATION

HAGAN BUILDING • PITTSBURGH 30, PENNSYLVANIA

Metallurgical Furnace Control Systems • Boiler Combustion Control Systems • Ring Balance Flow and Pressure Instruments • Control Systems for Aeronautical and Automotive Testing Facilities

For more data circle 536 on Post Card

MAINTENANCE? *what's that?*

With YARWAY Impulse Steam Traps, what little maintenance there is can be handled in a jiffy. There's only one moving part—a tiny valve.

When the trap must be cleaned or repaired, it can be done right in the line—in a matter of minutes.

Other YARWAY features:

- **Stainless steel—body and internal parts.**
- **Gets equipment hot in a hurry—and keeps it hot.**
- **Good for all pressures without change of valve or seat.**
- **Easy installation—small size, light weight.**
- **Non-freezing at low temperatures.**
- **Six standard sizes, ½" to 2".**

Want proof of performance? Try a YARWAY Impulse Trap and Fine Screen Strainer FREE for 90 days in your own plant. For free trial or free catalog, write . . .

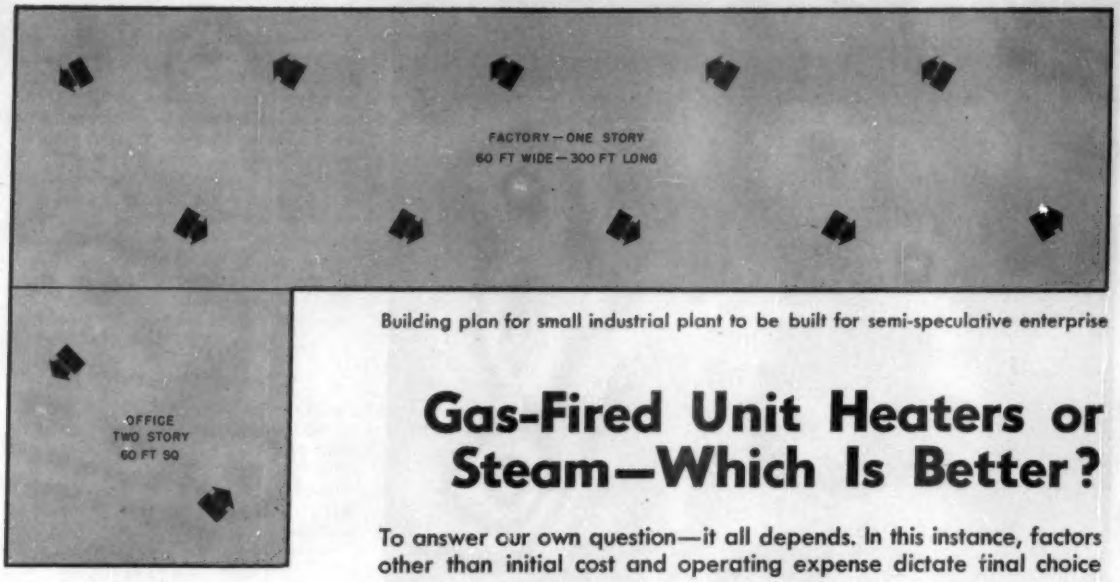
YARNALL-WARING COMPANY, 100 Mermaid Ave., Philadelphia 18, Pa.

This little valve —only moving part in a Yarway Impulse Steam Trap—floats on the condensate load. It gets equipment hot in a hurry and keeps it hot!

YARWAY impulse steam trap

OVER 1,000,000 YARWAY IMPULSE TRAPS SOLD—STOCKED BY 270 CONVENIENT INDUSTRIAL DISTRIBUTORS

For more data circle 537 on Post Card



Building plan for small industrial plant to be built for semi-speculative enterprise

Gas-Fired Unit Heaters or Steam—Which Is Better?

To answer our own question—it all depends. In this instance, factors other than initial cost and operating expense dictate final choice

By WILLIAM W. GAYLORD *

WIDE DISTRIBUTION of natural gas plus the development of automatically controlled gas-fired unit heaters have opened a new approach to the problem of heating small, isolated factories.

Take, for example, the case of the small industrial plant to be built for the production of a new item which has not yet received wide market acceptance, but which appears to have sufficient merit so that future expansion may reasonably be expected.

The plant is to be a one-story building, 60 by 300 ft, with a two-story ell, 60 ft square, for offices; total floor area, then, is 25,200 sq ft.

If the product meets the acceptance expected, it may be necessary to double or triple the plant area within a reasonably short time, but, for the present, the investment in the plant must be kept to a minimum consistent with satisfactory operation. The heating system should therefore be as low in first cost as practicable, provided, of course, that operating costs are reasonable.

Also, the system should be so designed that as much as possible of the equipment will be readily salvageable or reusable in the event it becomes necessary to increase the plant area or convert it to other uses.

The computed heat loss for the proposed plant (with an outside temperature of zero F) is 1,843,000 Btu per hour; the average heating season is 6500 degree-days. Natural gas is available at a cost of $0.95 per MCF, so the use of gas-fired unit heaters will be considered.

Fourteen unit heaters — ten in the one-story building and four in the two-story ell, located generally as shown in the drawing — will be used. An estimate works out like Table I.

For comparison, assume that a conventional steam heating system were to be installed. A boiler and condensation pump would be required in addition to the unit heaters and piping system. At least 250 sq ft of floor space would be required for the boiler and pump; this, of course, would have to be charged to the cost of the steam system. Costs for such a system work out like Table II.

These figures show that although the annual operating cost for the conventional steam system is $805.00 less than that using gas-fired unit heaters, the installation cost of the steam system would be $7698.00 more.

Standard sinking fund tables show that with 6 per cent interest it would require fourteen years for the savings in operating costs to amortize the additional investment.

If the plant in question were to produce a product of demonstrated earning capacity, the higher investment in a conventional steam heating system might be justified by the savings in operating costs; however, with the more or less speculative nature of the venture as stated here, this would not appear to be the case in this instance.

The system using gas-fired unit heaters would also have the further advantage of providing a larger portion of salvageable or reusable material should it become necessary to convert the plant to other uses or to increase capacity at a later date.

Table I. Cost breakdown of unit heating

Estimated Initial Cost of Unit Heating System	
12 vented unit heaters (128,000 Btu output each)	$4272.00
2 vented unit heaters (164,000 Btu output each)	840.00
14 line thermostats	250.00
Gas piping and valves, installed (3-in. main required)	700.00
Installing, venting, and wiring heaters	1400.00
Total	$7462.00

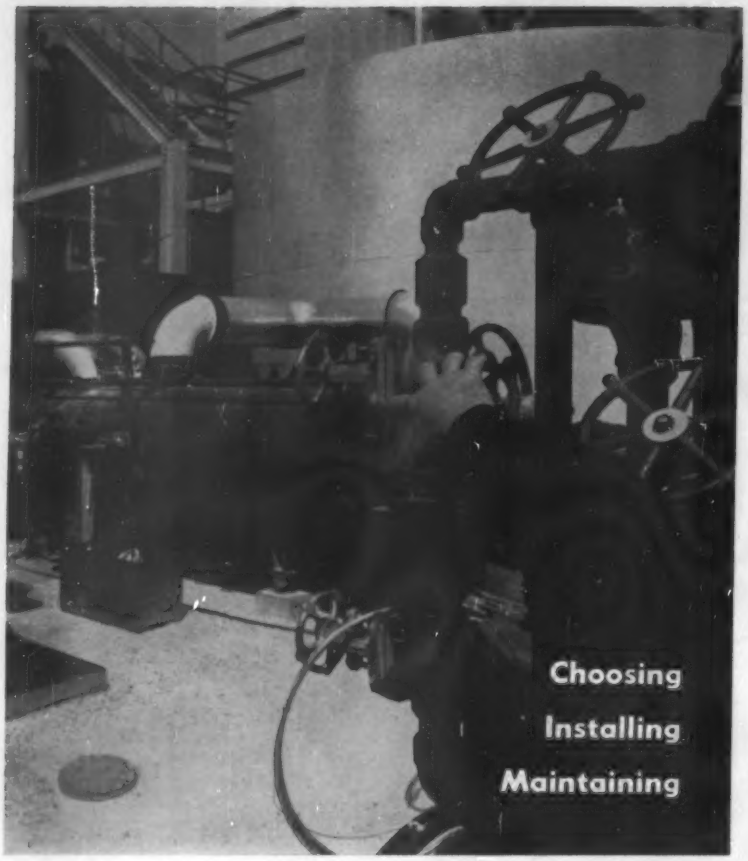
Estimated Annual Operating Costs for Unit Heaters	
From data in ASH&VE Guide, gas requirements will be:	
0.450 cu ft per 1000 Btu of computed heat loss per degree-day, or 5,400,000 cu ft at $0.95 per MCF	$5130.00
Attendance and maintenance	500.00
Total yearly operating cost	$5630.00

Table II. Cost breakdown, steam heating

Estimated Initial Cost of Steam System	
250 sq ft floor space at $8.00 per sq ft	$2000.00
80-hp package boiler with automatic burner for No. 4 oil	6000.00
10,000 gal. fuel oil tank, installed	1050.00
Condensation pump	250.00
10 unit heaters, 151,000 Btu (1150 rpm motor)	1850.00
2 unit heaters, 145,000 Btu (850 rpm motor)	390.00
2 unit heaters, 115,000 Btu (850 rpm motor)	370.00
Piping, valves, traps, etc., and installing heaters	2500.00
Furnishing and installing wiring, thermostats, all controls	750.00
Total	$15,160.00

Estimated Annual Operating Costs for Steam System	
From data in ASH&VE Guide, oil requirements will be:	
0.00371 gal. per 1000 Btu computed heat loss per degree-day, or 44,400 gal. at $0.093	$4125.00
Attendance and maintenance	700.00
Total yearly operating cost	$4825.00

* Consulting Engineer, Torrington, Connecticut



Valves

There is more to picking a valve than plugging pressure and temperature into a table and reading off a serial number. Think of a valve as a variable restriction in a fluid circuit first, then as a machine to be maintained, then as a cost-of-construction problem

By ROBERT JOSEPHS

SELECTION of piping equipment solely on a basis of pressure and temperature, without sufficient consideration for the special characteristics of the work to be done, was a common practice found in industrial plants surveyed by the author. A practice such as this always leads to false economy. At the same time, proper selection of the fewest possible types of valves, for similar services, offers excellent possibilities for reduction in piping maintenance costs.

The type of valve used, for example, is determined by the frequency of usage the valve receives, or the volume of flow desired. To apply a control valve properly, it is necessary to recognize its capabilities and limitations, which means to know what it can do and under what conditions. Such a valve may be described as a variable resistance in a fluid flow system. In any automatic control installation, it is as important a component of the system as the control instrument. The valve must be capable of performing in accordance with the dictates of the controller; otherwise, the installation will be unsatisfactory.

The gate valve is best for services in which valves are infrequently operated and where the disc remains in a fully opened or closed position most of the time. The gate valve is definitely not recommended for throttling service because the velocity of flow against a partly opened disc may cause vibration, chattering, and will result in damage to the seating surfaces. Also, when a gate valve is throttled, the disc is subjected to severe wire drawing erosive effects.

The globe valve is better suited for use where flow regulation service is desired, with the valve being frequently operated, or with its disc set in a partly opened or throttled position. The plug type disc globe valves are generally best for the most severe throttling services. Another point that must be considered is the shorter disc travel in the globe valve, as compared to the longer disc travel in the gate valve. The shorter travel of the globe valve requires less time to operate. The disc and seat are quickly and conveniently reseated, or replaced, which make them ideal for services that require frequent valve maintenance. The angle type globe valve has the same operating characteristics as straight-through globe valves, and is used when making a ninety degree turn in a line, thereby reducing the number of connections and labor required to make up a connection. It also has less restriction to flow than the elbow and globe valve it displaces.

Sizing Valves

Sizing of valves is the next important factor. The minimum size which will handle the peak load will generally give the most economical operation. On the other extreme, in handling liquids that must be pumped the lines must be large enough to keep the pressure loss at a minimum, or the penalty will be continued excessive pumping costs.

Maintenance of valves can be reduced to an almost unbelievable low,

merely by periodic inspection. The frequency of these inspections depends upon specific service conditions as stated above. It also depends on how frequently the valve is operated, whether every few minutes, once or twice a day, or once or twice a year. The more frequently the operation is performed, the more often the inspection should take place. If at any time there is evidence of seepage, a new disc should be installed and the seat reground immediately, or else the slight seepage will develop into a leak with wire drawing of the seat and the usefulness of the valve will be halted.

Water Hammer

Another, and more drastic, effect of leakage is the accumulation of condensate within the valve because if it is opened too quickly the resulting water hammer can be so excessive that it may destroy not only the valve and piping but the operator's life as well.

At all times, valve economy is an objective of good plant management. It is all the more important, at the present time, because of the increased cost of labor and valve replacement that have paralleled the increase in all expenses of plant operation. The majority of the valve failures can be prevented before they occur. To prevent failure, and insure the efficient operation of valves that contribute to plant production, valves must be properly selected, correctly installed, have adequate inspection and experienced piping maintenance.

Misapplications

Perhaps most typical of the ills existing in the improvised piping of recent years is the misapplication of valves. Because shortages existed during and for some time after World War II, it was understandable and condoned when improper types of valves were installed. Their use, however, may be adding to costs stemming from avoidable maintenance and inefficiency. This cannot be justified now that valves are readily procurable in proper types for individual services. When the service in which a valve is to be used requires special design and materials, it is poor economy to try to make an inexpensive valve do the job. The maintenance labor cost of a breakdown in a vital section of the plant, loss of production, if not actual valve failure, will far more than offset any initial saving.

A very common occurrence in a number of industrial plants, especially the smaller plants, is the improper installation of the globe valve and failure to determine whether the pressure should be above or below the disc. In some cases, it was found that plant engineers would refuse to install globe valves and instead standardized on the gate valve because of improper understanding of the working functions of a globe valve. This is a very uneconomical practice, as explained previously. The gate valve and the globe valve are each designed for a specific purpose.

Pressure Direction

The proper decision, as to whether to install the globe valve with the pressure above or below the disc, will be made if consideration is given to the danger and damage to equipment that would result if an interruption of flow took place because of valve failure. In a boiler feed line, for example, if the disc of a globe valve became detached from the stem, pressure on the top of the disc might cause it to seat and stop the flow. Here pressure below the disc is advisable. In the supply line to steam driven pumps, valve failure might permit pressure from below the disc to push it wide open and cause the pump to run wild. The pressure *above* the disc is recommended here or in steam lines to heater units, or to steam processing equipment.

Generally, however, installing globe valves with the pressure above the disc, especially in hot lines, will help to insure tight seating, and such practice is to be preferred unless conditions similar to those discussed here must be considered. Therefore, it is important to inspect all globe valve connections where service conditions would dictate whether the pressure should be above or below the disc.

Most pipe line valves fall into one of three large groups: stop valves; intermittently acting valves; and throttling, or regulating valves. Stop valves, of which the common gate and globe valves are examples, are usually hand operated, and remain either open or closed for long periods. Except for needle valves, when used as hand expansion valves in refrigeration service, regulating valves are usually automatic in operation. The intermittently operating valve is a stop valve which is either completely open or completely closed, the opening and closing at short intervals being regulated by an automatic device. The bucket operated steam trap is an outstanding type of this third group of valves.

Valve Functions

The functions of valves are mainly as follows: gate valves, quick opening valves and plug valves are used to halt the flow of fluids in a pipe line; globe and angle valves, needle valves, "Y" valves, diaphragm valves, butterfly valves, and blast gates are used to throttle or control the quantity of flow; swing check, lift check, ball check and non-return valves are used to control the direction of flow.

When installing pipe line valves all dirt, scale, and foreign matter should be carefully blown out of the pipe and valves before installation by means of either air or steam. Equipment such as boilers, pressure vessels, and tanks should also be freed of dirt or scale *before* valves are operated. If periodic cleaning or overhauling of automatic devices, valves, or equipment is caused by the presence or accumulation of dirt or foreign matter in piping, the installation of a sediment separator may reduce maintenance costs. After cleaning and during installation, valves should always be tightly shut to prevent the entrance of dirt. During erection, pipe lines must be properly and adequately supported to prevent sagging and throwing strain on valve bodies with resultant distortion.

Valve Positions

Even after all the preceding requirements of valves are met, an installation may malfunction because of a simple thing like position.

Wherever possible, all valves should be installed in the vertical position with the valve stem on top. Some valves have flow arrows cast in their bodies. Valves must be installed accordingly. Check valves in vertical lines can only function if the flow is upward.

After installation is completed, all lines should be flushed out with water or steam and all bolts and nuts on flange connections should be carefully tightened to eliminate leaks. Bolts should be pulled up on diametrically opposite positions until all are uniformly tight. If the valve does not close tightly, a wrench or extra leverage should never be applied to the wheel. The valve should be dismantled and seating surfaces inspected to find the source of trouble. Refacing of valve seats may be a sufficient remedy. To prevent distortion, suitable seat wrenches must always be used to remove valve seat rings. Valves on pressure lines should be closed slowly to prevent the strain on lines and fittings caused by water hammer.

Leaking Valves

For economic reasons, leaking valves should be inspected for evidence of other than normal wear and repaired or replaced as soon as possible. When the valves keep on leaking after the ordinary corrective moves have been made, the trouble is usually one of the following factors: expansion and contraction strains in the pipe line are not properly met by anchors and supports; excessive vibration; corrosive action is present; or dirt and foreign matter is in the lines. The expansion and contraction strains, when transmitted directly to the valves, will usually distort the valve bodies. The dirt and corrosion will cause valve leakage by releasing the stem threads, or will cause crystallization of the metal and as a result, serious damage will be done to the working parts. The correction of such conditions may often be achieved by the rearrangement of the anchors and supports, or by making slight changes in the line.

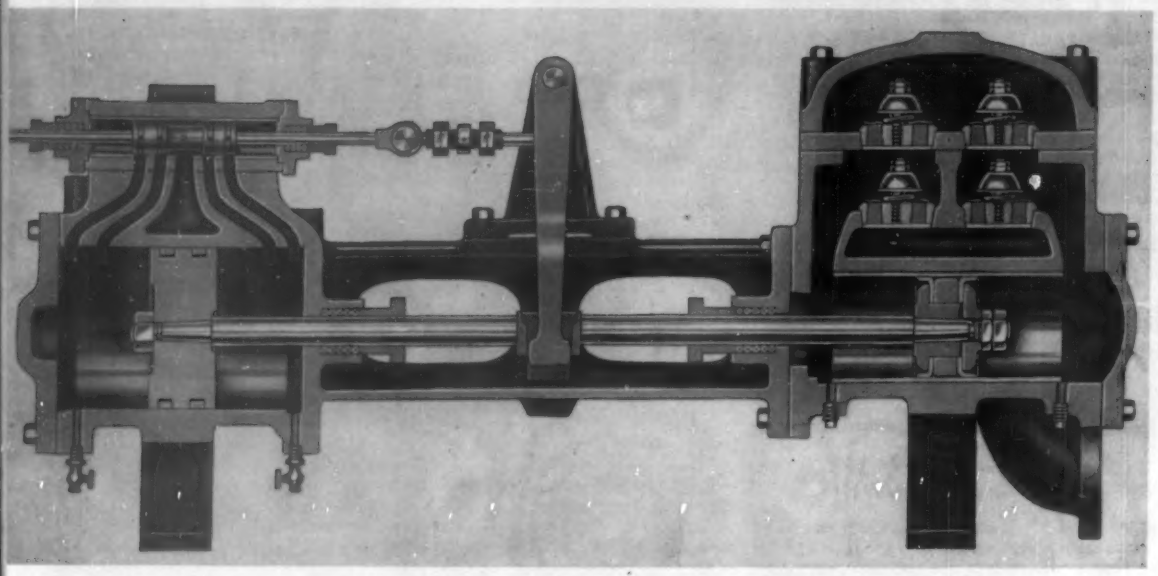


Fig. 1. Horizontal duplex steam pump with piston valve steam chest; this non-lubricated pump gives oil-free exhaust steam

Good Old Reciprocating Steam Pump . . . Still Young at Heart

Fig. 2. Vertical boiler feed pump with piston valve steam chest, non-lubricated

By W. B. PURSELL*

CTESIBIUS, an Alexandrian Greek, is reported to have invented the reciprocating pump back in 300 B.C., yet the operating principles of its modern counterpart remain exactly the same as those which the ingenious Ctesibius utilized in the pre-Christian era. If the test of time has any merit, the reciprocating pump passes with flying colors. Steam-operated reciprocating pumps, for instance, have been built for well over one hundred years but this type of pump is still the best for a number of pumping services. Unfortunately, its advantages have often been overlooked since the development of centrifugal, rotary, and other newer pump types — primarily, no doubt, because of lack of knowledge and information about how the older type functions and the conditions under which it can be applied to the best advantage. In many cases, the use of a steam pump not only ensures reliability of service, but also proves to be more economical in both power consumption and maintenance.

One of the most important features of a steam pump to an operating engineer is its ability to provide exhaust steam. In most instances, and especially in smaller plants, steam sufficient to operate the boiler feed pump provides sufficient exhaust steam for feedwater heaters — if the pump is a reciprocating type. However, the pump's exhaust steam should be oil-free; it is sometimes necessary, therefore, to use oil traps or separators in the exhaust steam line. Since the type of lube oil used in the steam cylinder has a direct bearing on its separation from the exhaust steam, this may become a problem.

Because of a variety of factors, such as type of oil in the steam, pump speed, or separator drainage, steam pumps have sometimes been replaced by centrifugal pumps, but nearly always with the concomitant disadvantages of increased operation cost and poor heat balance. This situation brought about the development of a non-lubricated reciprocating steam pump.

The non-lubricated pump utilizes a balanced piston valve steam chest

* Chief Engineer, Steam Pump Division, Warren Steam Pump Co., Inc.

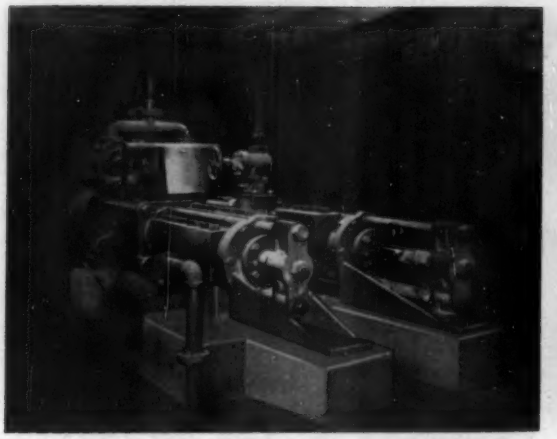


Fig. 3. Hydraulic pressure plunger pump with piston valve

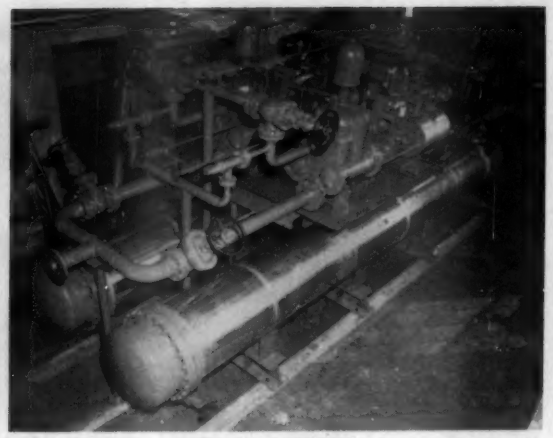


Fig. 4. Duplex piston fuel pumps installed on oil heater set

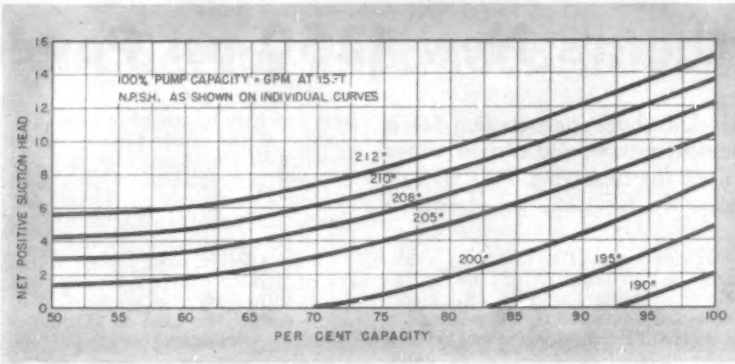


Fig. 5. Curves show net positive suction head required at pump suction flange to deliver hot water at sea level and to prevent vaporization in pump suction

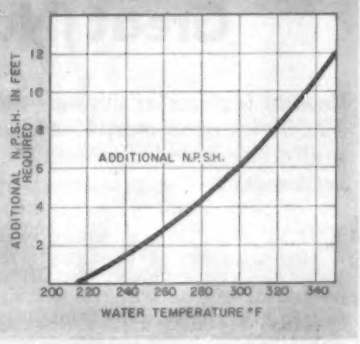


Fig. 6. Additional NPSH required for b-f water at temperatures above 212 F

of special design combined with bronze steam piston rings and bronze piston valve rings operating in a hardened, highly-graphitic iron liner (Fig. 1). As a result, exhaust steam completely free of lubricant contamination is available for use in the system, or for plant processes. By utilizing the exhaust steam from this type of pump, it is possible to recover up to 95 per cent of fuel cost.

Other advantages to be gained with this type of pump are its freedom from dependence upon an electrical supply, its flexibility to meet varying load conditions, and its efficiency at all loads; furthermore, it is readily adaptable to either manual or governor control, needs no lubricator of any kind, and requires no outside valve adjustment.

A fact often overlooked is that a reciprocating steam pump can be driven equally well with compressed air; these pumps are also being successfully operated with non-corrosive gas as a motive power.

A reciprocating pump is self-priming in that it can evacuate air from the suction line and can operate on a suction lift as high as 28 ft, handling cold water.

Any liquid, or semi-liquid, no matter how viscous, can be handled by a reciprocating pump, provided there are proper suction conditions. Typical examples are black strap molasses, crude oil, potato mash, acetates, tars, various syrups, etc. The flexibility of this type of pump with regard to capacity and pressure, while maintaining constant efficiency, is another important factor when these features are a deciding point. Also, its compactness, sturdy construction, and ability to withstand abuse, should be considered for applications where these features are essential.

On industrial oil burner sets, the steam pump has much to recommend it and is still used to a great extent. Most sets are built with two pumps, one as a standby, or to be used alternately at regular intervals. These pumps are of the duplex type, and when properly applied, insure continuous delivery with minimum fluctuation at almost any pressure desired. Here again, if exhaust is to be utilized, the piston valve steam chest has proved a real money saver.

Other types of steam- or air-driven reciprocating pumps, in addition to horizontal duplex piston pumps, are outside-end-packed plunger pumps, horizontal single piston vacuum pumps, vertical single and vertical duplex piston pumps and horizontal single and duplex hydraulic plunger pumps.

While the horizontal piston pumps are suitable for most applications, there are certain instances when the plunger pump can best be used. For example, when discharge pressures exceed the limit of a piston pump, or when a liquid is handled with abrasive particles in suspension, the plunger pump is recommended, because no moving parts subject to metal friction come in contact with the liquid, except the plunger and throat lining. This contact, being above the bottom of the liquid volume acted upon by the plunger, allows a settling-out of the abrasive particles and a low abrasion rate is obtained, much under that of the piston-type pump.

Vertical single and duplex piston pumps, although sometimes thought of as exclusively for marine use, also have advantages on industrial applications, due to space-saving requirements and reduced wear on stuffing box *continued on page 104*

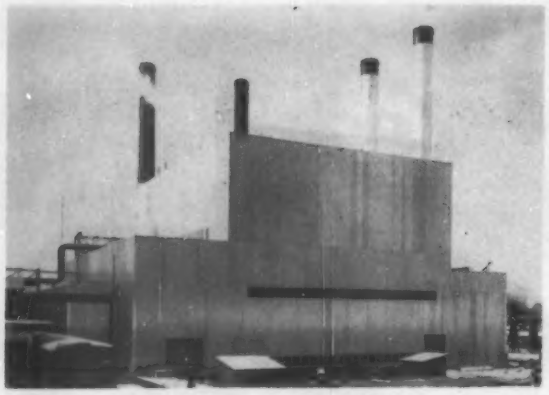


Fig. 1. Exterior view of new steam power plant at East Millinocket showing attractive corrugated aluminum siding

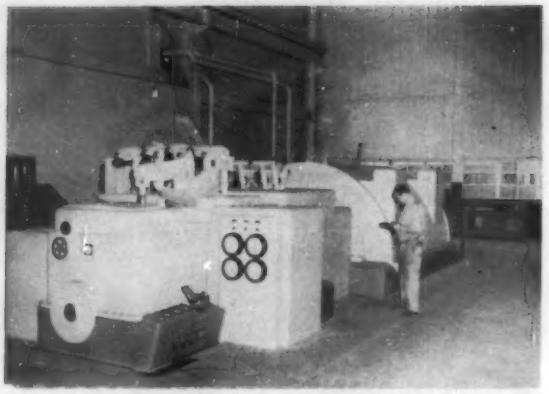


Fig. 2. 12,500-kw unit takes steam at 1250 psi 850 F, supplies extraction and exhaust process steam at 200 & 40 psi

Great Northern's New 1250-psi Power

Unusual features of this new plant include hydrogen cooling for a 12,500-kw generator, 40-cycle electrical system, and a river water pretreatment and demineralizing plant for supplying 200 gpm of feedwater make-up at the purity required for 1250-psi operation

FIRST STEP in a scheduled two-step expansion of Great Northern Paper Co.'s paper mill at East Millinocket, Maine, adds 250 tons daily capacity, a 276 in. 2500 ft per min paper machine, and a 150 ton per day chemi-groundwood mill.

To meet increased steam and power demands of this expansion, a 300,000 lb-per-hr boiler and a 1250-psi, 855-F back-pressure extraction turbine generator were installed in a new powerhouse. Second step, now under way, will add another paper machine and another boiler and turbine generator later this year.

Principal features of the new plant are: 1. Use of a 1250-psi turbine generator primarily as a reducing valve between the high-pressure boiler and the low-pressure process steam systems; 2. Use of a hydrogen-cooled generator in a relatively small size; 3. Electric generation and use of power at 40 cycles instead of the customary 60 cycles.

The company utilizes electric power and large quantities of steam for making newsprint. An unusual feature of the new paper mill is a process for making groundwood pulp from hardwood. This is a chemical process developed after pilot plant tests by the company and at a substantial saving in power without sacrifice of paper quality.

The company has a large mill at Millinocket, Maine, about 10 miles away, and an existing mill at East Millinocket, both on the Penobscot River. It has also developed hydroelectric installations with a rated capacity of 130,000 hp, and has several undeveloped hydro sites available on the same river. The hydroelectric plants and the two paper mills are connected by the company's own electric transmission system and this operates at 40 cycles, at which frequency both hydro and steam power are generated.

Reason why this 40 cycle frequency is retained today is that the cost of converting to 60 cycles would not be justified because much of the process equipment is driven by relatively large motors, many of several hundred horsepower. Cost of fabricating these motors for 40 cycles is little more than for 60, they do the job satisfactorily, and the cost of converting them or replacing them and their controls would be too great.

Among the many interesting features of this new power plant is the high-capacity demineralizing installation for providing feedwater make-up for the 1250 psi boilers. Since much of the steam generated is used for process work, approximately 15 per cent demineralized water make-up is required for the boilers.

Source of raw water for this purpose is the Penobscot River, in which total dissolved mineral constituents are relatively low, thus favoring the ion-exchange process. Suspended solids and other foreign matter consist of silt and fibrous fragments from bark and leaves, and organic materials from decaying matter.

The organic materials are undesirable in boiler water at pressures above 400 psi. They may reduce the capacities and expected life of strong base anion resins used in demineralizers and may appreciably affect the quality of the treated water. It is imperative, therefore, that suitable chemical pretreatment be employed to reduce or remove completely the objectionable constituents from water before demineralization starts.

Coagulation of color bodies, which are negatively charged colloids, was accomplished by the application of acidic coagulants such as aluminum or ferric sulphate at relatively low pH with the required dosage usually proportional to water color. Sufficient alkali was added to react with the coagulant and adjust pH. Because of the difficulty in densifying bulky color flocs, particularly in water near the freezing temperature, a coagulant aid was found necessary to produce a tough, dense, readily settleable floc. Activated silica prepared by total reaction of the sodium-oxide content of sodium silicate with sodium bicarbonate was used successfully for treating the colored river water.

Laboratory coagulation tests with the various treating chemicals showed that 60 ppm of aluminum sulphate, 10–16 ppm of alkali as sodium hydroxide and 10 ppm to 12 ppm of activated silica utilized at pH of 6.2 resulted in good coagulation of the suspended solids and reduced chemical-oxygen demand and color to less than 5 ppm. Further reduction in chemical oxygen demand and color in applying chlorine in quantities up to and including breakpoint and superchlorination followed by activated carbon feed was negligible. Partial chlorination of river water was considered essential, however, to prevent fouling of treating equipment and pressure type filters.

Demineralizing equipment, Fig. 6, includes duplicate two-bed demineralizers, each consisting of 6-ft-diam cation and anion exchange units containing 70 cu ft of Nalco HCR high-

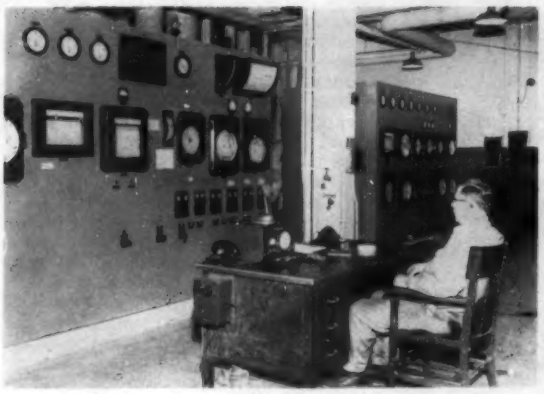


Fig. 3. Operator controls new 300,000-lb-per-hr boiler and 12,500 kw generator from central automatic control panels

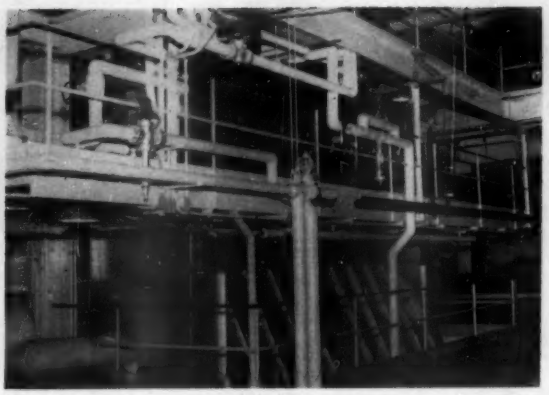


Fig. 4. Front of 300,000-lb-per-hr boiler. Now equipped for burning fuel oil but with provision for future coal burning

Plant Serves Expanded Paper Mill

capacity polystyrene resin and 85 cu ft of Nalco SBR Type I highly basic resin, respectively. Manifolds are equipped with Conoflow air-operated Saunders valve nests. Other equipment includes cycle timers for automatic control during regeneration, strong acid and caustic controlled volume pumps, regenerant mixing chambers, controls and instruments. Semi-automatic operation is provided with push-button initiation of regeneration cycles and return to service. Max. flow of 200 gpm is obtained through one pair of exchangers during regeneration of second pair.

During the pretreatment process, river water is delivered to the bottom inlet of the flash mix tank located ahead of the clarifiers where alkali, alum and chlorine solutions are introduced in proportion to water flow to develop pin-point floc during a 5-min detention time. Addition of activated silica is made to the mix-tank effluent discharging to the Accelators designed for detention of 2 hr to coagulate and settle the color bodies and suspended material. Clarified effluent from the Accelator flows by gravity

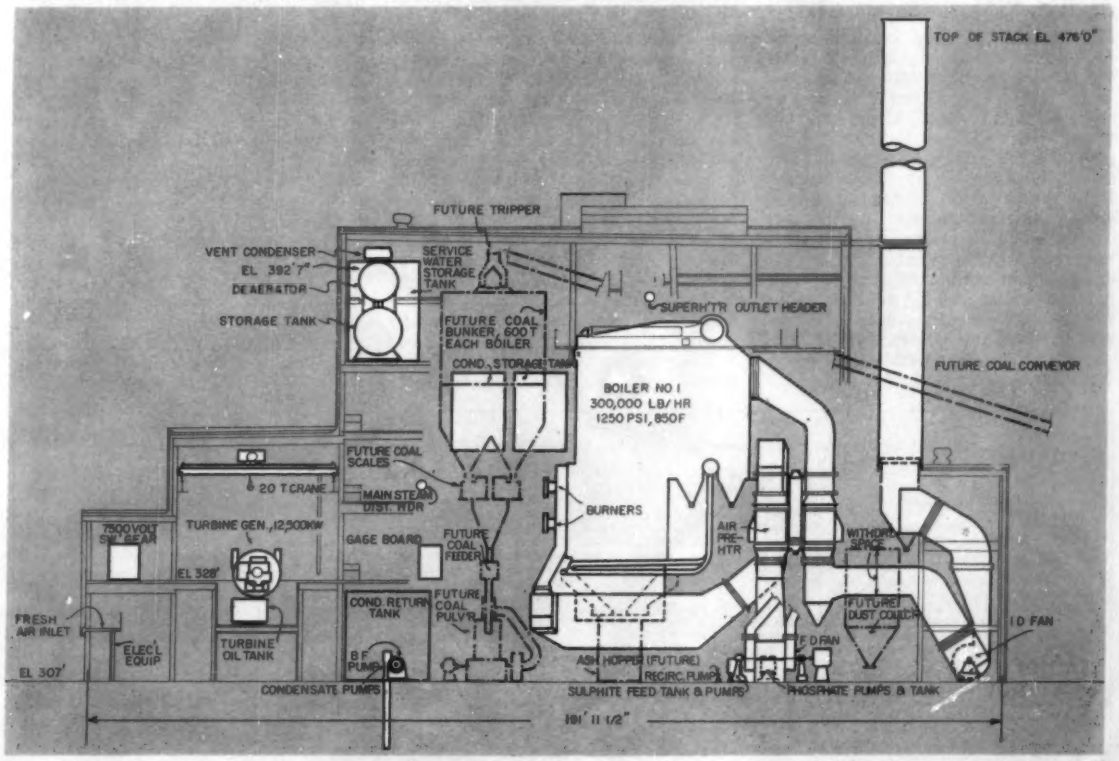


Fig. 5. General cross-section through new plant supplying steam and power to Great Northern's expanded paper mill

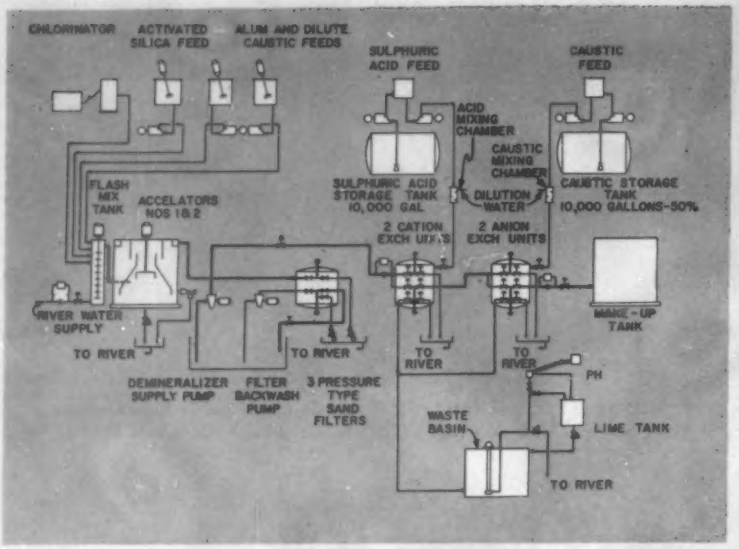


Fig. 6. Simplified flow diagram of feedwater treatment and demineralizing plant

through pressure-type sand filters to the clear well.

With continuous operation, complete control of the treatment process is maintained with one full-time day-shift water-plant operator and intermittent checking by a boilerhouse operator during night shifts.

Performance of the Accelator clarifying units operating at design capacity with river water temperatures ranging from near freezing to 75 F has shown that the equipment is capable of delivering effluent with less than 5 ppm turbidity as guaranteed. The conservative upflow rate of about 1 gal per sq ft per min, together with 2 hr detention, has proved of distinct advantage in handling the lightweight floc resulting from precipitation of organic material in the river water.

Years of mill operation with Corliss reciprocating engine drives for the paper machines utilizing 10 to 12 psi exhaust steam for heating paper machines dryer cylinders had resulted in fouling the steam and condensate systems, as well as the dryers, with oil and oily sludges.

During the mill-expansion program, existing paper machine drives were replaced with modern steam-turbine drives, thus removing the source of oil contamination of condensate returns to be used in the high-pressure boilers. A problem of some magnitude concerned clean-up of the steam and condensate systems, and the dryer cylinders of the four existing paper machines to remove accumulations of oil, sludges, scale, iron oxide, and dirt.

In April, 1954, before replacement of the Corliss engines, a cleaning program was initiated to test the effectiveness of cleaning chemicals. Solutions of Oakite No. 19, alkaline phosphate and Oakite No. 8, a detergent, in concentrations of 1 lb and 0.25 lb per gal, respectively, were injected at rates of 18 gal per hr into the 10-psi exhaust header delivering steam to the paper machines. Two periods of application, one of 72 hr and one of 56 hr, were used initially during which condensate was discharged to waste.

The results of tests showed average oil concentration of samples taken at various the points before chemical addition was 9.2 ppm. The daily average for one week after termination of chemical addition was 3.3 ppm and later increased to about 5 ppm. A sample taken from the oil trap at the end of the exhaust-steam header prior to introduction of cleaning solution contained 488 ppm of oil; after treatment average oil concentrations were about 15 ppm. All sampling points showed large increases of oil concentration during chemical addition with a general increase for about 5 days.

As the Corliss engines for each of the four paper machines were replaced with steam turbines the cleaning program was continued, reducing concentrations of oil in the condensate to approximately 2–3 ppm. To clean the systems more efficiently, it was necessary to mix several hundred gallons of hot cleaning solution and circulate it through the dryer cylinders of each paper machine and the condensate system during week-end shutdowns of the machine. Also, where convenient, condensate lines and traps were dismantled and cleaned mechanically to remove oily sludges. Cleaning was continued until late October, 1954, when analyses of condensate samples showed less than 1 ppm of oil. Except for short periods after weekend shutdown, condensate returns remained clear and free from oil contamination and are being accepted for use in the high-pressure boiler.

With the elimination of oily exhaust steam and the removal of oily deposits from the piping and equipment, it became necessary to provide other protection against corrosion and iron pick-up. In accordance with current practice, a neutralizing amine is introduced to the deaerator storage tank to raise pH of condensed steam to 8.5.

Recent analysis of condensate samples shows average iron content is 0.26 ppm.

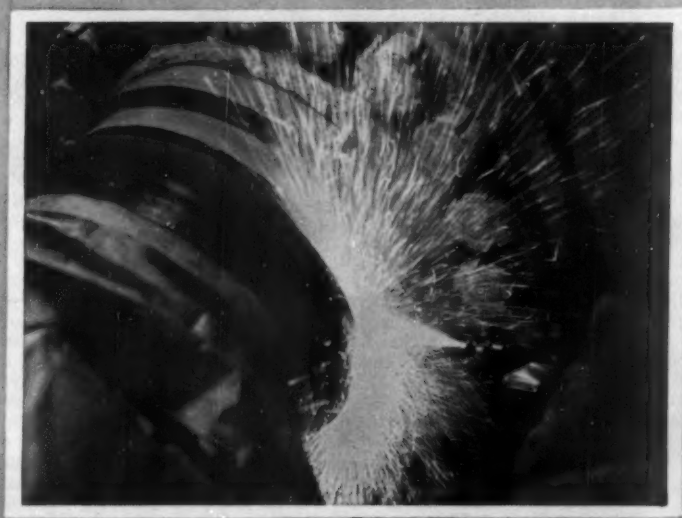
For the information and illustrations in this article we are indebted to Roy V. Weldon, Executive Vice-President, and W. F. Daniell, Manager of Engineering, of the Great Northern Paper Company, and H. F. Davidson, Stone & Webster Engineering Corp. (ASMR Paper 55-SA-75).

List of Principal Equipment for Unit No. 1, New Power Plant, Great Northern Paper Co.

Boiler: 1 — Capacity 300,000 lb per hr, designed for 1300 psi, 855 F; fired at present with fuel oil, with provision for pulverized coal firing if desired. Combustion Engineering, Inc.
Turbine Generator: 1 — Capacity 12,500 kw; non-condensing extraction type; throttle steam conditions 1250 psi, 850F; extraction of 175,000 lb per hr at 210 psi, exhaust at 40 psi. Generator, 2400 rpm, 6900 v, 3 phase, 40 cycles, hydrogen-cooled. General Electric Co.
Water Treatment Plant: Deaerating Heater equipment, blow-down equipment, deionizing equipment. Cochrane Corp.
Boiler Feed Pumps: Ingersoll-Rand Co.
Boiler Feed Pump Drives: Steam Turbines. Westinghouse Electric Corp.
Closed Feedwater Heater: Westinghouse Electric Corp.
Forced Draft Fans: The Green Fuel Economizer Co., Inc.
Induced-Draft Fans and Driving Motors: Westinghouse Electric Corp.
Switchgear: Westinghouse Electric Corp.
Station Service Unit Substation: I.T.E. Circuit Breaker Co.
Water Clarification Equipment: Infilco, Inc.
Chemical Pumps: Milton Roy Co.
Automatic Combustion Control: Bailey Meter Co.
Steel Piping (fabricated): Midwest Piping & Supply Co.
Pipe Hangers: Carpenter and Peterson.
Turbine Lubrication: Bowser, Inc.
Valves: Steel valves, The Chapman Valve Mfg. Co. Small high-pressure steel valves, instrument valves, Edward Valves Inc. Safety relief valves, Farris Engineering Corp. 40 psi relief valves, Atwood & Morrill.
Other valves, Manning, Maxwell & Moore, Inc. and Ohio Injector Co.
Fuel Oil Heaters: American Locomotive Co.
Fuel Oil Pump Equipment: Warren Steam Pump Co., Inc.
Suction Heater for Storage Tank: The Griscom-Russell Co.
Service and Other Pumps: Ingersoll-Rand Co. and Pennsylvania Pump & Compressor Co.
Various Drive Motors: General Electric Co.
Instrument Air Compressor: Chicago Pneumatic Tool Co.
Welded Steel Tanks: The Portland Co.
Boiler Feedwater Regulation, Steam Desuperheating Equipment — Copes-Vulcan
Flow Meters: Hagan Corp.
Level, Temperature, Pressure Controls and Indicators: Mason-Neilan Regulator Co.
Steam Pressure, Reducing and Desuperheating Control Equipment: The Swartwout Co.
Temperature Recorders: Minneapolis-Honeywell Regulator Co.
Steam Traps: Armstrong Machine Works.
Turbine Room Crane (20 ton): Whiting Corp.

So—You're Going to Overhaul Your Turbine Generator!

This is the sixth article in a series describing the scheduled overhaul of a 25,000 kw turbine generator at U. S. Steel Corp.'s South Works in Chicago. A list of past and future articles is given below. When all the articles have been published we plan to reprint the whole series. To reserve a copy of the reprint write to the Editor



VI. METALLIZING TURBINE SHAFT

Gland runner erosion had extended into the shaft, which had to be repaired without distortion by heating and without being weakened by machining. Metallizing solved the problem

Hard layer of stainless steel being applied in form of continuous metal spray as shaft is slowly rotated

I. Preview of whole series. II. Planning . . . Preparation . . . Preliminary work. III. Removing turbine cover and spindle. IV. Turning turbine cover. V. Reblading. VI. Metallizing eroded shaft. VII. Work on generator. VIII. Machining turbine spindle. IX. Checking clearances. X. Re-aligning turbine spindle. XI. Balancing. XII. Miscellaneous work. XIII. Safety and time-saving ideas

Fig. 1. Area inside white square shows a view of gland with the top half of its casing removed

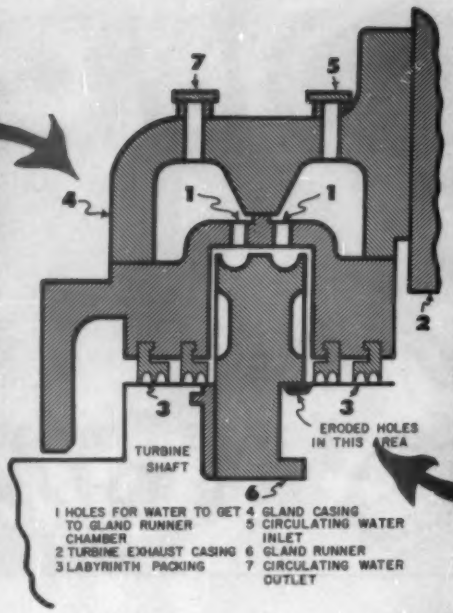


Fig. 2. Vertical section through top half of gland casing and runner. Lower casing seen in white square in Fig. 1

Fig. 3. Part of erosion that occurred under gland runner. Location of this area shown in Fig. 2

Fig. 4. Arrow shows location of part of turbine shaft where erosion occurred

VI. METALLIZING TURBINE SHAFT

SOME TYPE OF SEAL must be provided where the turbine shaft ends pass through the cylinder walls to prevent steam leakage or air infiltration. The glands for this turbine are of the combination labyrinth and water seal type. Figure 2 shows a section through the low pressure gland, while Fig. 1 shows the gland with cover removed.

Referring to Fig. 2, sealing water is admitted to the gland through the circulating water inlet (5) and flows in the supply duct between the outer and inner gland casing. A series of holes (1) through the inner casing lead the water into the gland runner chamber and out through the circulating water outlet (7). Excessive water leakage is prevented by labyrinth packing (3). There will be no external leakage during normal operation since the pressure on the turbine side is below atmospheric.

Over a period of years gland runners and gland casings become eroded and must be replaced. The erosion of the low-pressure runner in this case was quite severe having extended into the shaft in places, as shown in Fig. 3.

Metallizing solved the problem of repairing the eroded spots on the shaft without distortion due to heat or weakening the shaft by machining. With the metallizing method described here, the heating effect on the shaft was negligible, and after metallizing with stainless steel the new surface had more resistance to corrosion than the original surface.

The process, carried out by Metallizing Inc., was done in the following steps:

1. The holes in the shaft were ground clean and undercut slightly (Fig. 5) to provide a keying effect for the metal with which they would be filled.

2. Pure nickel was then deposited in the holes from a nickel rod held in a special vibrating holder known as a "nervous weld pistol" (Fig. 6). By tapping the rod on the shaft and then withdrawing it immediately, a small blob of nickel was deposited, and though the nickel was actually in the molten state when dropped, it was so small that it cooled immediately, with negligible heating effect on the shaft.

3. After a few blobs of nickel had been deposited they were peened down with a vibrating hammer (Fig. 7). Then a few more blobs were deposited and peened, and this process was repeated until all the holes had been filled (Fig. 8).

4. The next step was to take about 1/16 in. off the shaft across the surface to be repaired. This was done with an ordinary lathe cutting tool mounted in a compound holder beside the shaft (Fig. 9).

5. A series of parallel grooves were then cut in the turned surface (Fig. 10).

6. The grooved surface was then rolled with a hard steel knurled roller, called a preparation tool, shown n Fig. 11. The object of this rolling was to partially close the groove openings (Fig. 12) to provide a better key for the metallizing.

7. Surface preparation having been completed, it was then sprayed (Fig. 13) with a thin coating of special alloy called "Sprabond." The purpose of this alloy was to act as a bonding agent between the metal of the shaft and the stainless steel metallizing.

8. On top of this Sprabond was sprayed the main coating of stainless steel (Figs. 14 & 15). The turbine spindle was rotated slowly, at about 6 rpm, and the metal was sprayed on continuously. With this method the metal was put on very thinly, so there was little heating of the shaft, and more than 12 hours were required to build up a 1/16 in. layer of stainless steel. Areas adjacent to the surface being sprayed were carefully masked to limit the deposit to the area to be built up.

9. As sprayed, the stainless steel surface was rough (Fig. 16), so it was ground to a fine finish with a small portable grinder as shown in Figs. 17 and 18. The metallized surface was extremely hard, and the grinding operation took about 36 hrs.

Fig. 19 shows new gland runner being installed.

Fig. 5. Cleaning out end undercutting holes in shaft to provide keying for the metal with which they are to be fitted

Fig. 6. Filling holes with pure nickel. Metal is deposited in small blobs to avoid heating and distorting the shaft

Fig. 7. After a few blobs of nickel had been deposited they were peened with a vibrating hammer. Then more nickel was added and process repeated till hole was full

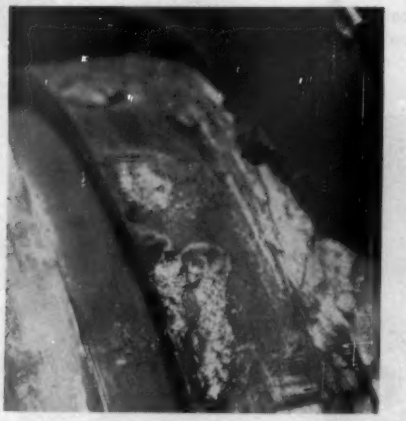


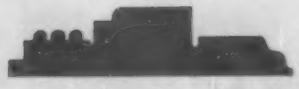
Fig. 8. Holes filled with nickel deposited and peened as shown in Figs. 6 and 7

Fig. 9. Next step was to take a [illegible] skim cut off area to be repaired to give a smooth surface for metallizing

When all these articles have been published, the series will be reprinted. Here are some ways the reprints can be used:

1. To train young engineers.
2. To brief new men before an overhaul.
3. To show management why so much time is needed for an overhaul.
4. To illustrate parts when discussing any turbine generator problem.

If you want one or more reprints write to the Editor.



VI. METALLIZING . . .

Fig. 10. Right. After turning, a series of parallel grooves were cut in the surface. Reasons are explained in Figs. 11 and 12

Fig. 11. Rolling grooved surface with a hard steel roller, called a preparation tool, to partially close the groove openings to provide key for the metallizing

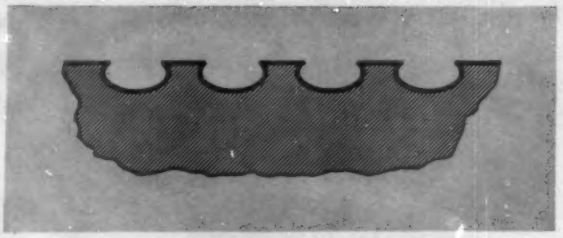


Fig. 12. Grooving and rolling with preparation tool gives keying effect as illustrated in the above diagram

Fig. 13. Grooved surface then sprayed with thin coat of "Sprabond", a bonding agent for the metallizing

Fig. 14. Spraying with 420 Cr. Carbon stainless steel. Adjacent areas were carefully masked for protection

Fig. 15. Stainless steel wire for spraying was fed into spray gun from a coil held in pan seen behind operator

Fig. 16. Built-up surface before grinding smooth. More than 12 hrs spraying were required to build up a 1/16 in. layer

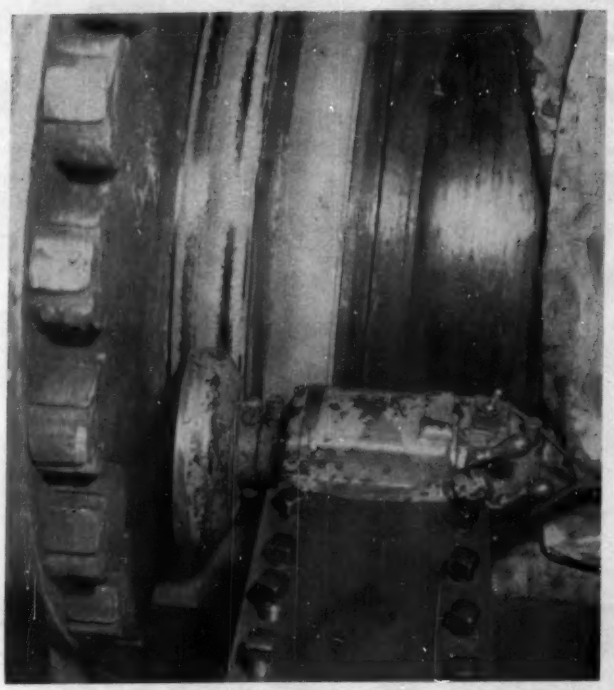


Fig. 17. Grinding stainless steel surface after spraying. Turbine spindle was rotated at 6 rpm during this operation

Fig. 18. Grinding was a slow process and took about 36 hrs owing to the hardness of the stainless steel metallizing

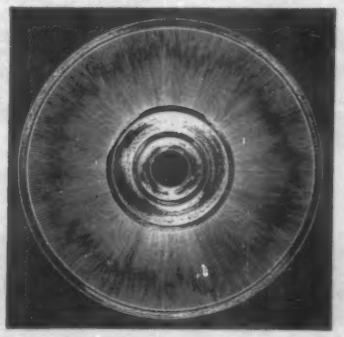


Fig. 19. Fitting new gland runner over metallized surface

Vinyl Paint Hard to Handle? . . . Spray It HOT

The superior corrosion-resisting properties of vinyl-based paints are well known, but the difficulties of applying them in the field without controlled conditions have discouraged widespread adoption of these coatings. Here is a practical method that gives results

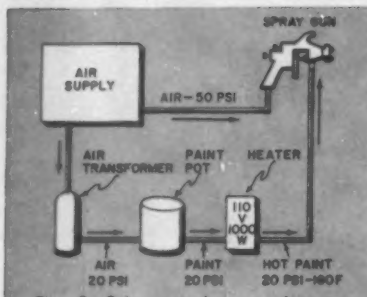


Fig. 2. Schematic layout of system using the non-circulating type heater

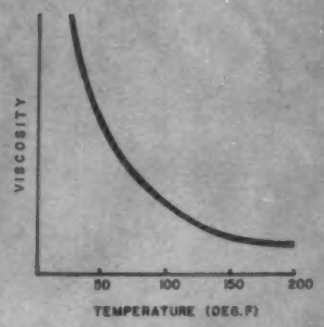


Fig. 3. Typical viscosity-temperature curve for vinyl paint, system "A"

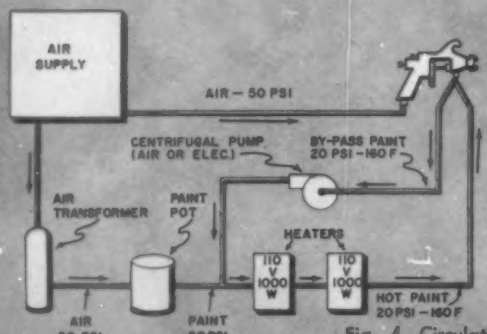


Fig. 4. Circulating type of heater system provides more uniform work

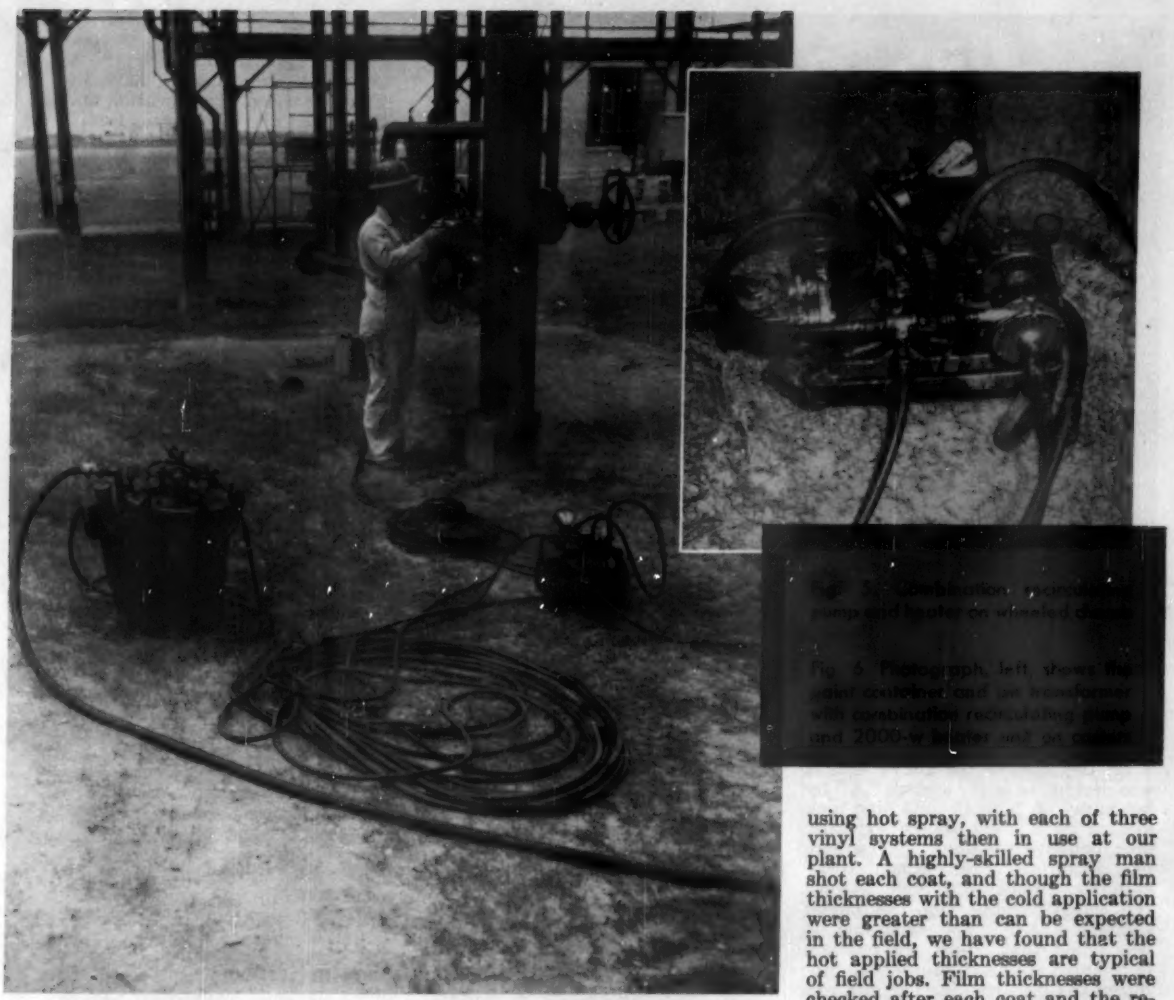
By B. C. WRIGHT *

ONE OF THE MOST valuable weapons in the fight against corrosion is vinyl-based paint. It has been proven that it has excellent resistance to more different corrosive exposures than any other air dried paint, *providing* that the system is built up to the thickness of the "magic five mils." Vinyls are not easily brushed on, nor do they work easily in the spray gun unless quantities of thinners are used. This adds up to the greatest drawback in the use of vinyls — the numerous coats needed to build the system to the necessary thickness.

Seeking to overcome this drawback and utilize the excellent protective qualities of vinyls, we investigated different methods of paint application. One of the methods experimented with was that of hot spray. It has proven highly successful. We have found that by applying vinyls hot it is possible: to obtain 3 mils per coat; to expand the field of spray application; to obtain a better job — and all of this is obtained with less-skilled spray painters and for a lower total cost. Indications are that hot spray can at least double the life of vinyls in our more severe exposures.

There has been considerable activity since World War II in the hot application of lacquers, automotive

* Maintenance Engineer, Carbide and Carbon Chemicals Division, Union Carbide and Carbon Corp., Texas City, Texas.



enamels, and other product finishes; but so far as could be learned, no hot spraying had been done with vinyl paints on maintenance and construction work prior to our work at Texas City.

As with most viscous fluids, the viscosity of vinyl paint is lowered as its temperature is increased. For some elevated temperatures, the ratio of viscosity change to temperature change becomes very small. It therefore follows that if the vinyl paint is heated and sprayed in that temperature range the actual spraying viscosity is practically constant regardless of ambient temperatures. With a hot spray application, the atomization air pressure, the paint pot pressure, and the gun adjustments can remain constant throughout the day and seasons. Furthermore, no thinning is required, thereby eliminating another "painter's choice."

In hot spray application, paint is delivered to the gun at approximately 160 F. This temperature causes the immediate evaporation of much of the solvents, and this solvent evaporation so depresses the temperature of the paint that the actual temperature of the paint when it strikes the surface is about ambient or slightly above. This solvent release increases the viscosity of the vinyl paint, permitting the deposition of a much greater film thickness without sag.

The first heater purchased was a portable, electrically-heated, noncirculating unit originally designed for application of automotive enamels. This heater is placed in the paint line between the paint pot and the gun and strapped to the spray man. It is Underwriter's Laboratory approved, light, ruggedly constructed, insulated, and equipped with a factory-set thermostat adjusted to 160 F. This setting has proven ideal for vinyl paints.

Preliminary evaluations included spraying one sandblasted barrel and two KTA † type panels by the conventional spray method, and another identical set (barrel and two panels) using hot spray, with each of three vinyl systems then in use at our plant. A highly-skilled spray man shot each coat, and though the film thicknesses with the cold application were greater than can be expected in the field, we have found that the hot applied thicknesses are typical of field jobs. Film thicknesses were checked after each coat and the results are recorded in Table I. It will be noticed that with each system there was a very small gain in the hot application of the primer over the conventional application. It is of interest that in paint B the 2-mil gain in total thickness occurred mostly in the second coat.

Film continuity was checked electrically after each coat and with each system continuity was found to be superior with hot spray. Visual inspection by the naked eye and under magnification indicated the superiority of the hot application and that it had more gloss and had flowed out better.

The six barrels were placed on a rack one foot over high tide on the shore of Galveston Bay, and one hot-sprayed and one cold-sprayed KTA type panel from each vinyl system A, B, and C was exposed at our two most corrosive plant locations. Frequent inspections have proven that we obtained an excellent coating on all six systems, but in every individual detail the hot spray system has proven better than the cold spray. Numerous checks for adhesion have

† Kenneth Tator Associates; the panel is described in the December, 1952, issue of *Chemical Engineering*.

Fig. 7. Spray gun in this photograph shows the siamese type of connection used with pump for recirculating hot vinyl paint to prevent cooling when gun is off

shown that hot spray definitely adheres better.

On the basis of the above tests it was decided to apply system "A" by hot spray on a small unit pipe rack located in a very severe exposure area, consisting of about 3900 square feet of surface. Conventional spray equipment was used throughout with the single exception of the heater element placed in the paint line. It was found that 20-psi pot pressure and 50-psi atomization pressure produced the best results. The gun was opened wide and the painter was instructed to apply the paint in a single continuous pass until the surface looked wet. We found that it was unnecessary to thin the paint. We obtained a minimum film thickness on the second and third coats of 3 mils per coat with the average thickness close to 3½ mils. Further this average was very consistent. Total film thickness for the three coats ranged from 7½ mils to 9 mils, with 8½ mils the approximate average. Checks were made for adhesion and continuity and these checks confirmed the excellent promise that hot spray of vinyls had shown on preliminary testing. With respect to costs, even on this first job, it was found that the total labor cost was approximately 20 per cent less than a similar job using a conventional 5-coat vinyl system. Paint coverages on coats 2 and 3 were approximately 90 sq ft per gal. Very close inspection after one year of service has revealed no detectable deterioration of the vinyl coating.

Our paint specifications, since the first pipe rack job, have required the application of the prime coat by either brush or conventional spray. We considered the hot application of the first coat as unnecessary. The remainder of the specifications call for the No. 2 and 3 coats of system "A" to be applied hot.

On subsequent jobs we have increased the speed of application and have realized film thicknesses from 3 to 4 mils and labor cost reductions of approximately 30 per cent. An important extra advantage of the hot spray system has been the reduction in over-spray due primarily to reduced pot pressure. What little over-spray occurs is dry, which means that hot spray can be used in many places where conventional spray would not be possible due to paint drifting and settling on other surfaces. Direct spray from a distance of from 4 to 8 feet may be brushed off, simply because it is too dry to adhere.

Painters Like Hot Spray

Our painters like to use hot spray because they stay cleaner and they believe that with it there is less health hazard than with conventional spray. Also, they like hot spray because it appears that anyone can become an expert with it. No thinning is required and sags seldom occur. They just shoot on a slow single pass until it looks wet. That is all there is to it.

Several paint manufacturers are showing considerable interest in hot applications and have formulated some experimental vinyl paints that indicate on preliminary test that they can match or exceed the performance we are obtaining with paint "A". However, it must be stressed that, from our investigations, only a few conventional vinyls lend themselves to hot spray.

At the present we are using 13 hot spray units, four of which are the type already described. The other 9 are of the circulating type that allows the paint to circulate past the gun and through the heater when not actually spraying. This provides for more uniform temperature of the paint at the gun and consequently a more uniform job.

Some of the advantages we have gained by hot spraying of vinyl paints on some 1,900,000 square feet are listed in Table II. As far as can be determined, there are no disadvantages to this system and we are convinced that it affords excellent protection.

Table I. Averages of a number of tests on the thicknesses of vinyl paint films

System	Coat No.	Approx. thickness applied cold (mils)	Approx. thickness applied hot (mils)	Approx. increase (mils)	Approx. increase (per cent)
A	1	1+	1½−	¼	20
	2	2½−	4½+	2½	90
	3	1½	4	2½	160
	(Total)	5	10	5	100
B	1	1+	1½−	¼	20
	2	½−	1½+	1¼	250
	3	1½	1½	0	0
	4	1	1½	½	50
	(Total)	4	6	2	50
C	1	1½−	1½+	¼	15
	2	1½+	2−	¼	15
	3	3	4	1	30
	(Total)	6	7½	1½	25

Table II. Hot spraying of vinyl-based paints can offer these ten advantages

1. More build-up per coat (fewer coats required)
2. No damaging drift from over-spray
3. Lower labor cost per sq ft (fewer coats)
4. Not necessary to add thinners in field
5. Easier application
6. Healthier working conditions for spray man (less fog, less thinner to evaporate)
7. Increased coverage per gallon (reduction of over-spray loss)
8. Better finish, less sagging
9. Better film continuity (film shrinkage small due to greater solvent release during spraying; film denser, and flow-out is better)
10. Build-up on edges

CTI Research Yields Cooling Tower Performance Standards

Mobile Test Unit developed by Cooling Tower Institute gives comprehensive performance records on 20 selected industrial cooling towers. Result:—Standards now published to give you complete field testing procedure for performance of your installed tower, grades of lumber recommended for it, how to figure design

COOLING TOWER INSTITUTE has issued three publications of industrial standards for recommendation to purchasers and manufacturers of industrial water-cooling towers. They are the first of a series that will finally define a CTI Code Tower. They constitute a significant contribution toward advancement in technology, design and performance of cooling towers.

These documents are the result of a five-year program of research conducted by the technical committees of CTI. One year of preliminary study and three years of field investigation were followed by another year of intensive field testing and statistical analysis.

Basic procedure for testing the water-cooling capability of any industrial tower is described in detail in the new CTI bulletin ATP-105 titled CTI Acceptance Test Procedure. Special grades of redwood lumber recommended by the Cooling Tower Institute for use in industrial towers are described in CTI bulletin STD-101 titled CTI Grades of Redwood Lumber. Supplementing the specific grades is CTI bulletin STD-102 on Structural Design Data, in which design stress allowables are given for CTI Grades of lumber.

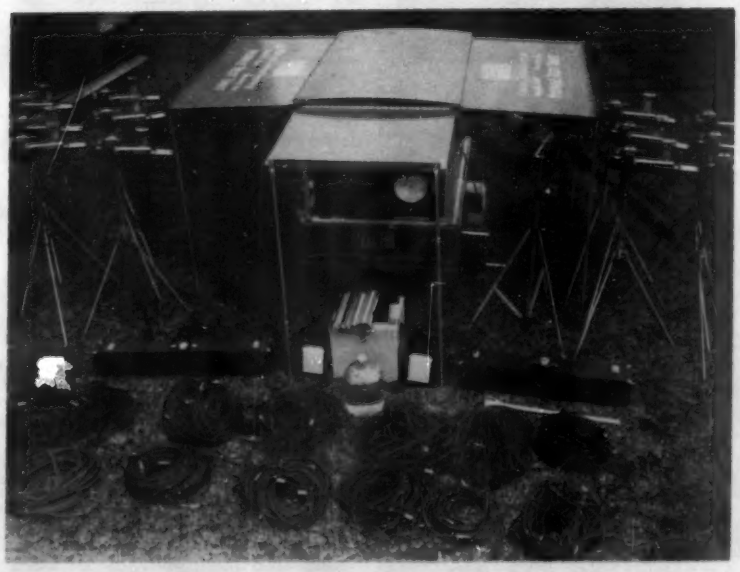
Of particular interest to design engineers and users of industrial towers is the complete description of field testing procedure which may be used either for determination of normal operating capacity of an installed tower or for the determination of compliance with performance guarantees. The research program which developed the Acceptance Test Procedure was sponsored by the major manufacturers of industrial water-cooling towers through the Cooling Tower Institute.

Describing the background of the program, CTI Executive Manager Raymond C. Kelly states that during one three-month period in the summer of 1954, within a geographic triangle 880 miles by 623 miles by 590 miles, the performance characteristics of 20 selected towers were observed under comprehensive instrumentation. All together, 55,456 significant readings were recorded by the CTI Field Service Department crew under the supervision of James L. Willa, chief field engineer. An additional 10,502 quantitative values were calculated and reported to the participating manufacturers and users with 4460 ozalid prints used to distribute the data to interested parties.

Mobile Test Unit assembled by the Cooling Tower Institute and operated in the Gulf Coast area (see cut) includes 12 portable electrical resistance type psychrometer stations, each consisting of a wet bulb and a dry bulb temperature-sensitive element and a motor-powered blower designed to deliver air at a 1000 fpm velocity across the temperature-sensing elements. Each of these stations is electrically connected to a recording chart type instrument on which the psychrometric values are permanently recorded. A wind direction and wind velocity station is connected to separate strip chart recorders and a variety of psychrometers, anemometers and thermometers are included in the CTI unit.

Special instruments developed by the group were calibrated and used continuously for checking the performance of electronic equipment. Effects of atmospheric change and the effect of the tower upon itself were studied in minute detail. Essential elements of the investigation formed the basis for the recommendations described in the CTI bulletin ATP-105.

In cooperation with the U. S. Forest Products Laboratory and the California *continued on page 104*



View of mobile test unit used in CTI research program. It gave data forming basis of recommendations for testing tower performance, checking guarantee

—— CTI Bulletins Available ——

Bulletin ATP—105: Acceptance Test Procedures for Water-Cooling Towers, Mechanical Draft, Industrial Type

Bulletin STD—101: CTI Grades of Redwood Lumber for Structural Applications in Water-Cooling Towers, Mechanical Draft, Industrial Type

Bulletin STD—102: Structural Design Data for Application of CTI Grades of Redwood Lumber in Water-Cooling Towers, Mechanical Draft, Industrial Type

Bulletin TSC—302 (published in 1953): Cooling Tower Wood Maintenance

For more information about these new cooling tower standards and copies of the bulletins listed, write the Editor or jot COOLING TOWER, plus the numbers of the bulletins you want, on the prepaid post card in this issue and mail it to us.

Sewage and Waste Treatment Increases Nation's Need for Kilowatts

Forecasts of electrical power demands stress rapid growth in coming years. Here is little-known factor that will boost consumption

By R. W. SIMPSON *

DURING THE PAST several years, the subject of stream pollution abatement has received considerable attention by the Federal government, State governments, municipal governing bodies, industry, and the public at large. From the activity at all levels of government, it is apparent that pollution abatement is a "must."

The Federal government has been developing comprehensive programs to prevent or abate pollution. The country has been divided into eleven major drainage basin areas, with study and reports prepared for each basin. Continuous research in the field of waste treatment is under way, both at Public Health Service laboratories and at universities. Financial and technical aid has been given to states in surveying existing conditions of pollution. Legal steps have been taken to prevent pollution of interstate waters; nearly every state has passed legislation to prevent or control pollution, most states having taken aggressive action to clean up their streams.

Effects Widespread

Almost all areas in the United States have been affected by water shortages during the past several years, and one of the contributing factors to water shortages, especially in industrial areas, is pollution of surface supplies. National production has more than doubled in the past 15 years, but continuation of this industrial growth is dependent upon a safe, pure, adequate supply of water for both domestic and industrial needs.

All this adds up to the inescapable conclusion that municipal and industrial waste treatment will increase greatly in the coming years. In the treatment of these wastes, electrical power is a basic requirement.

In evaluating pollution abatement, in terms of electrical power required for treatment processes, it is well to consider the estimated requirements for the entire country. Table I indicates existing conditions and future requirements for municipal sewage treatment plants. From this data, it appears that there is need for construction of many new plants, as well as replacement, enlargement, or additions to most of the existing plants. It is apparent that, at the present time, only about one-third of the total population of the country is served by municipal sewage treatment plants, and of the plants existing, only about 53 per cent are now adequate. The Public Health Service estimates that to provide adequate municipal sewage treatment plants will cost approximately 4.5 billion dollars up to 1960.

Fig. 1. Stream pollution abatement is big business. To safeguard waterways for civic, industrial expansion, waste treatment demand forces more new construction

Industry Worse Off

Table II indicates the existing and required industrial waste treatment plants. Data on industrial waste plants are not as complete, but it is apparent that industries are in poorer condition, treatmentwise, than municipalities. Although no accurate cost estimates are available for industrial waste treatment requirements, it is known that the organic loading discharged to streams from industries exceeds that from municipalities, and the cost must be at least equal to the cost for municipal treatment, or over 4.5 billion dollars.

The most apparent need for power in sewage and waste treatment is for pumping the sewage or industrial waste; pumping of waste is required to some degree in nearly every municipal or industrial waste treatment plant. It is difficult to evaluate this requirement. In order to arrive at a quantitative figure, a hypothetical project has been prepared to use as a yardstick in appraising the future needs.

A city with a population of 100,000 has been selected as a unit for consideration. Based upon nominal design figures, a flow of 100 gallons per capita may be anticipated, providing a total flow of 10,000,000 gallons per day. Calculations have been made to indicate the power requirements for

* Chief Sanitary Engineer, Gilbert Associates, Inc.

pumping, as well as for sewage treatment by means of standard rate trickling filters, high rate trickling filters, the activated sludge process, and the three methods, with open sludge beds as compared to vacuum filtration.

Power Requirements

The necessity for pumping the raw sewage, either within the municipality itself along the sewer lines, or at the treatment plant site, depends upon the topography of the area. In arriving at a quantitative estimate of power requirements in the hypothetical project, it has been assumed that one-half of the total flow would require pumping, with a total dynamic head of 100 feet. On this basis, the power requirements for pumping would amount to 2650 kwh per day. Since the flow of sewage varies hourly, with the normal habits of the people, peak flows amounting to three times normal rates can be anticipated, necessitating demand changes in most cases.

In calculating the power requirements for sewage plant operation, motor horsepower and the length of running time were considered. From data, it appears that for a standard rate trickling filter plant, with open sludge drying beds, approximately 740 kwh of power may be required daily. A demand requirement for this type treatment will not be too significant. If vacuum filtration of sludge is used, rather than open drying beds, the power requirements will be increased approximately 420 kwh per day, with operation over an 8-hr period for 5 days per week.

High Rate Filters

Economy in construction may dictate construction of a high rate filter plant; but in this case, the power requirements are more than double that for a standard rate trickling filter plant, approximately 1640 kwh per day, and with vacuum filtration, increasing to 2060 kwh.

Construction of an activated sludge plant, when sewage characteristics warrant, will result in lower initial construction costs than trickling filter plants, and produce a high degree of treatment, although operating costs are much higher. Calculations indicate that an activated sludge plant, to meet the conditions of the hypothetical project, would require approximately 6140 kwh per day, and with vacuum filtration of sludge 6560 kwh per day. It should be noted, however, that the power requirements may be reduced approximately one-third by effluent sludge gas utilization, although the plant would require capacity for the full demand, usable only on option of the plant operating staff.

Since every industrial waste plant presents a different problem, it is difficult to predict the power requirements for any one plant and apply the factors to the national needs. Based upon experience in plant design, it is safe to predict that the power requirements for industrial waste treatment would approximate one-third that for municipal waste treatment, since most industrial waste plants are dependent upon chemical treatment to remove solids and organic matter, rather than biological organisms.

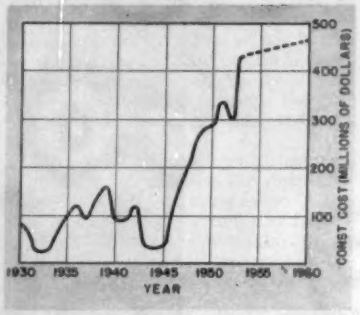


Fig. 2. Graph shows course of municipal sewage disposal construction since 1930

Having determined the power requirements on a unit basis, it next appears in order that the unit be applied to the national requirement figure. Table III has been prepared to indicate the load that might be expected, based upon the hypothetical case discussed, and the national requirement for sewage treatment to serve approximately 60,000,000 people. The actual load will vary with the type of treatment selected by municipalities and industries, but the maximum, minimum, and average figures will serve as a guide. The data indicate that for municipal sewage treatment, a maximum load of 3,960,000 kwh per day could be expected, if all new plants were activated sludge. If all new plants were standard rate trickling filters, the load would be only 420,000 kwh per day. However, due to the varied construction, the average requirement of 2,220,000 kwh is more justified.

Trend Is Guide to Future

It is further apparent that industrial waste treatment will not result in any great increase in the foreseeable future.

Having estimated the predictable loads, it would be interesting to note the actual construction trend. Figure 2 has been prepared to show the construction trend from 1930 to 1953, and has been projected to 1960, with an ultimate expenditure of 4.5 billion dollars, between 1950 and 1960. The data indicate construction at the rate of approximately 450 million dollars per year. This curve indicates the rate of construction necessary in order to maintain the required program, and should be a guide to future power requirements.

To sum up, estimates indicate that by 1960 we can expect an increase of 3,840,000 kwh per 24 hr for sewage treatment and pumping, and 740,000 kwh per 24 hr for industrial waste.

Table I. Municipal sewage treatment facilities—existing now and required †

	Number	Population Served
Municipalities with sewers	11,811	91,762,000
Municipal sewage plants	6628	56,494,000
Plants with inadequate capacity	2541	—
Plants with adequate capacity	3531	—
Plants with adequacy undetermined	583	—
New sewage plants required	4209	31,010,200
Sewage plant replacement	722	3,508,400
Additions or enlargements	1645	25,699,700
Undetermined	1627	—
		Costs
Total—new plants, replacements, additions or enlargements	6576	$2,500,000,000.
Allowance for obsolescence, new communities and population growth —to 1960		2,000,000,000.
Total estimated cost		$4,500,000,000.

Table II. Industrial waste treatment facilities—existing now and required †

	Number
Industries discharging wastes	10,501
Industries not treating wastes	3659
Industries treating wastes	2595
Industries undetermined	4147
Industries with inadequate treat. capacity	657
Industries with adequate treat. capacity	1090
Industries with adequacy undetermined	848
Requirements	
New waste treatment plants	2793
Replacements	98
Additions or enlargements	591
Undetermined	5532
Cost	
Estimated to equal or exceed Municipal Waste Treatment—therefore	$4,500,000,000 +

Table III. Estimated power requirements, national basis, 60 million persons

Sewage Treatment —kwh per capita	Power Requirements —kwh per 24 hr.
Maximum—0.066	3,960,000
Minimum—0.007	420,000
Average—0.037	2,220,000
Sewage Pumping —kwh per capita	
Maximum—0.053	3,180,000
Minimum—0	0
Average—0.027	1,620,000
Industrial Waste Treatment	740,000

† *Data from* Water Pollution in the United States, *Federal Security Agency, PHS, Pub. No. 64, 1951.*

Fig. 1. This idea was worth money to both Detroit Edison and Archie Jago, who developed device for installing and removing ram box liners easily

DE Co.'s Work Simplification Program

Fig. 2. Before Work Simplification practices were applied, lift truck toted four transformer supports boxed in cartons

Fig. 3. After simplification study, 12 supports are carried and stored in same space formerly occupied by four in boxes

The Detroit Edison Co.'s Work Simplification Program has yielded operating improvements typified by reduced stack temperatures, easier stoker maintenance, better working drawings, elimination of needless stores packaging, reduction in stores—and many other savings

By LILLIAN STEMP*

THE DETROIT EDISON Company's five power plants (a sixth under construction at River Rouge) have a maximum generating capability of 2,495,000 kilowatts. They provide power for an area containing more than half the population of the State of Michigan. In each of these power plants, key personnel are being given Work Simplification training. As a result, many new methods are being proposed to make the work of producing power easier and more efficient.

The opportunity for Detroit Edison employees, including power plant personnel, to submit proposals for work improvements is not new. The way was opened about three years ago with the announcement of an Employee Proposal Plan. This plan not only provided a channel for the consideration of proposed improvements, but also a system for the payment of awards for those adopted. Under the plan about three thousand proposals have been submitted, and about 40 per cent have been adopted and used.

* Technical Writer. See March, 1955, issue of POWER ENGINEERING for biography. This is third and final article by Lillian Stemp on simplification techniques practiced by several large utilities.

Since Work Simplification training has been given to many of the company's supervisors and some employees, there has been a definite increase in the number of proposals submitted, and in most instances these show the results of that training. More thought is being given to the development of the ideas. In addition, those submitting the proposals are better equipped, because of Work Simplification techniques, to work out solutions to problems. Work Simplification is thus becoming a real factor in the achievement of a more successful Employee Proposal Plan.

All Employees to Be Trained

Work Simplification was introduced to the Detroit Edison power plant staffs at Delray, Conners Creek, and Trenton Channel in the summer of 1954, after representatives from each of these locations attended a Work Simplification Institute given by the company. In time it is expected that all the employees in power plants will be given Work Simplification training. The number and quality of work improvements turned in under the influence of this training should go a long way towards increasing the efficiency of power production.

Detroit Edison's Work Simplification booklet reminds employees that analysis is important in challenging every detail of a job. The qualities that analysis requires are those which we all have. They include: (1), *natural curiosity* about things we see — not just taking things for granted; (2), the *ability to question* — putting "the job on the witness stand" and then "why-ing?" the heck out of it, making it justify itself, and insisting on getting the right answers; (3), the *power to generalize* — following through with reasons or facts after wondering about something, asking if a fundamental principle is involved and if it will apply in all cases; and, (4), the *capacity to apply* — which means action, as otherwise all the wondering, questioning, and generalizing is wasted.

Asking the questions, "what is done?", "where is it done?", "when is it done?", "who does it?", and "how is it done?" about an entire job, and every part of a job, brings out whether or not it is really necessary to perform certain operations, and if they have to be done, how they can be done more easily.

Reduces Stack Temperatures

Using this questioning technique, Edward Russell, of the Conners Creek power plant, found a way to reduce stack temperatures by approximately 50 deg while maintaining the desired air heater temperatures. His idea saves coal and improves boiler operation. It involved changing the method of using the cold air bypass damper against a Bailey recirculating damper controls through the forced-draft fan controls. In this way, the damper remains in wide-open position until the forced-draft fan reaches its maximum loading pressure. The change permits control of air heater temperatures by recirculating through the motor-operated recirculating dampers instead of through the cold air bypass damper, thus reducing stack temperatures.

Sometimes an old idea in use elsewhere can be adapted for particular operations. Or, an idea once in use may have been discarded and forgotten although it is still usable under certain conditions. When you apply Work Simplification principles, these old ideas can often be revived. That was the case with Charles Butlin when he proposed that while the fourth and seventh stage heaters were out of service for repairs that "the heater pump be made to drain directly from the tenth stage to the boiler feed pump suction, rather than to the condenser by way of the 13th stage heater." In the past this had been standard procedure. By reinstating the practice, no additional cost was incurred yet it saved heat and fuel and resulted in a more efficient operation of the heater pumps.

With Archie Jago, of the Delray plant, it was the designing of a special tool that simplified the installing or removing of ram box liners on boiler stokers. Mr. Jago's idea not only saved time but also provided a safety factor for the tool that lessens chances of hand injuries.

A change in materials made the work of preparing three-dimensional models for power plant piping arrangements easier. Instead of making pipes from dowels and joints turned out of wood, they are now made from plastic and magnesium tubes and rods. These materials bend more easily thus making the job easier and saving time as well.

L. Duenweg, Director of Training Services at Detroit Edison, reports that Work Simplification in all departments has been indirectly responsible for many examples of cooperation, between various divisions of the company, to eliminate waste of energy, materials, and time.

For example, the mechanical divisions and boiler divisions got together to find a way to expedite production of cross-section layout drawings. Such drawings are very useful since they not only present a combined layout of the turbine generator, steam generator, and other facilities, but also serve as an index for other detail and assembly drawings of the components which make up the power plant.

Simplifies Drawings

These cross-section drawings formerly were either drawn or traced from existing drawings. Then Mort Adcock, supervisor in Boiler, and Phil Heidman, of the Mechanical Division, looked at the problem via Work Simplification methods. They pooled their resources and began to reproduce the cross-section drawing by photography. This requires matching Boiler and Mechanical Division drawings in order to get the final product. It has worked for the Rouge Power Plant. The nature of that plant is such that each unit is supplied by different manufacturers and requires a similar drawing for each unit. Through photographic reproduction, these important drawings are not only expedited but there is a savings in cost as well.

Another example of cooperation

Fig. 4. Work simplification techniques have universal application; here, model maker uses plastic and magnesium tubing in place of wood to simplify mock-ups

and resultant benefit to both participating divisions occurred when a problem was presented at one of the Work Simplification conferences. The problem was to find techniques which would eliminate certain repetitive operations in the making of drawings. This applied to notes, sketches, and instruments, grouped or singly. One of the techniques evolved was the use of adhesive-backed pre-printed translucent appliqués. Juan Suguitan, supervisor in the Concrete Division, and Al Jones, supervisor in Piping, both recognized possible applications in their work. Mr. Suguitan reported that a rather lengthy standard note specifying the procedure for doing the work was usually lettered by hand on many of the drawings made by his division. He thought that the note could be placed on about 125 of the drawings a year by means of the appliqués instead of the hand lettering.

Other Uses

Al Jones thought the appliqués might work not only for notes but for sketches as well. He is using them for several standard inspection notes and for a sketch of a meter pit, which happens to be used on many drawings by the Piping Division.

The explanation of how these appliqués are used follows: The repetitive sketch or note wanted is made up and printed on the appliqué in a press in quantities. Matte surface material is used because it erases well and takes pencil or ink readily for additions or revisions. The note or sketch has a protective backing which is removed just before applying. The appliqué is then placed and adheres to the desired location on the drawing.

Incidentally, Jones has also been using Copyflex Transparencies to simplify drafting, and thus make the work not only easier but at the same time eliminate repetitive operations. The transparencies were recently used to lay out the route for a 54-in. gas main for Detroit Edison's River Rouge power plant. He reports that "from the architectural plot plan, enough transparencies were made for the number of different layouts required so as to take care of practically all the background information needed in the layouts. This represents about 90 per cent of the drafting." The advantage of using the transparencies is that they make it practical and economical to make studies of several schemes. This was the case with the routing of the gas main. A different scheme was indicated on each transparency, and from these, prints were obtained for approval of the most practical and economical layout. The same procedure was also used for the storm water drain at the River Rouge power plant.

Another advantage of these transparencies is that in cases where studies are partially completed, the work can be released up to a certain point without jeopardizing progress on the remainder of the study.

Still another example of how Work Simplification promotes coöperation between various divisions is in the method of delivery of construction materials. This, of course, applies to any portion of the plant. Previously, an order for materials would be sent to one of Detroit Edison's warehouses by the Construction Engineering Division, listing every item required for a particular job. The warehouse would sometimes have to back order items, but would deliver those items which were available immediately. Tradesmen would start a job and then not be able to continue with it because the rest of the materials were not on hand.

Alvin Herschleb proposed that the design engineer be notified of the back-ordered items needed for a specific job, so that he could secure substitute materials, if necessary, that were available. Proper scheduling would thus save many man-hours on the job and in the delivery of the materials.

This simplification resulted in a review of various procedures that had been in use in these departments and brought about improved coördination between the engineering departments and the construction department.

Stores, purchasing, and engineering got together to discuss ways of applying Work Simplification principles to save space, do away with needless packaging, and to eliminate the need for unnecessarily large orders, as well as to cut down on over-all company investment in a wide variety of materials. One of the many improvements resulting was the handling of transformer supports. Space and packaging cost was conserved. Where formerly four packaged transformer supports were loaded on a lift truck, twelve of these supports can now be moved and stored in identically the same space. The difference is in the elimination of excelsior and cardboard box packing. The supports are made secure by wire or metal tape and a snip of these is all that is necessary compared to the tedious unpacking previously required.

Waste Eliminated

Needless packaging of this type simplified waste problems as well. When the Stores' simplification studies were made, it was found that at one of the Detroit Edison warehouses more than five truckloads of waste was disposed of weekly. By doing away with unnecessary cardboard and wooden boxing, truckloads have been cut to one a week. Coöperation of this type adds enthusiasm for Work Simplification by the manufacturers as well. One of the manufacturers reported that it had saved 60 per cent storing space in their own factory as well as a 30 per cent saving in packing as a result of Detroit Edison's Work Simplification efforts.

These examples show the influence of Work Simplification training and indicate the possibilities for improvement in power engineering not only by power plant personnel but by others indirectly concerned. Just recently, Victor Lindstrom, of the Delray Construction and Maintenance department, submitted a proposal that made coal car repairs easier. He designed a jig to compress springs and thus simplify repairs on coal and ash car couplings and draft gear. As part of the Detroit Edison's award plan, he received $117 for this idea.

Most interesting is the story of Robert Ashley, substation operator at Detroit Edison's Grand River Substation. He noticed the water gage on his automobile instrument panel and evaluated its possibilities in relation to a problem which had been bothering him for some time. The problem was the growing consumption of water at the Grand River Sub. After studying the water gage in his automobile, he believed that some sort of regulator could be used in water-cooled transformers to stop the water intake once the transformer was sufficiently cooled. He furnished details of his idea and these were turned over to Leo Harris, in the Electrical System. The result was a thermostat that will save the company tons of water per year, not only at the Grand River Sub but the seven other Detroit area subs as well.

Solar Energy Association Announces Program for World Symposium at Phoenix, Ariz.

PRELIMINARY PROGRAM has been established for the World Symposium on Applied Solar Energy to be held at the Westward Ho Hotel, Phoenix, Ariz., next November 1 through 5.

Sponsors of the meeting are the Association for Applied Solar Energy, Stanford Research Institute and the University of Arizona.

Among the papers scheduled by noted authorities on solar energy are: The Sun's Energy, Dr. Farrington Daniels, University of Wisconsin; Survey of the Domestic Uses of Solar Energy, Dr. H. C. Hottel, Massachusetts Institute of Technology; and Space Cooling With Solar Energy, Dr. George O. G. Löf, Denver, Colo.

Contributions from abroad will be made by Prof. Felix Trombe, Laboratoire de l'Energie Solaire, Paris, France, speaking on High-Temperature Furnaces; R. N. Morse of the Commonwealth Scientific and Industrial Research Organization, Australia, discussing Solar Water Heaters; and Dr. Hiroshi Tamiya of the Tokugawa Institute for Biological Research, Tokyo, presenting a paper on Chlorella for Food.

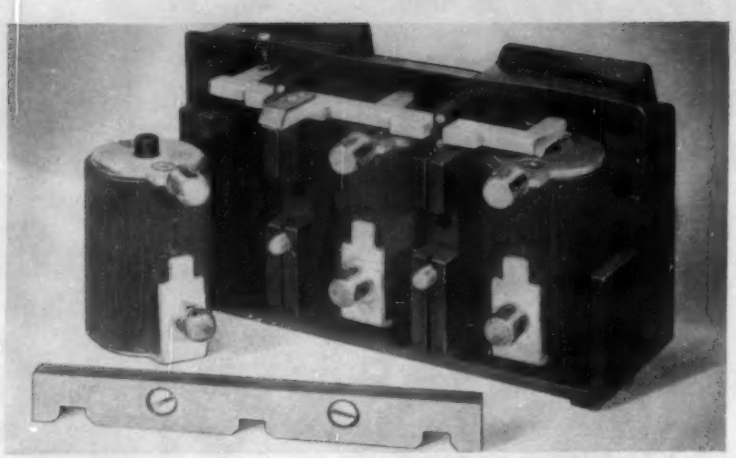


Fig. 1. Shows current-limiting fuse trip unit which fits into molded circuit breaker housing. Plunger at top of fuse trips out all three phases when fuse blows

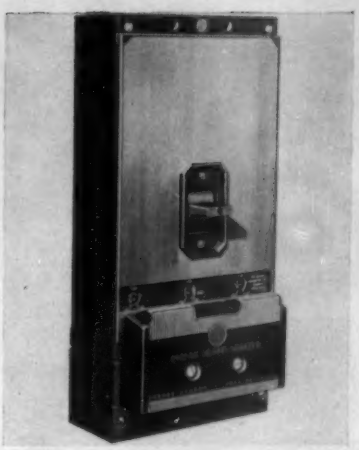


Fig. 2. Molded housing contains fuses, thermal trip and magnetic overload trip

New Breaker Uses Current-Limiting Fuses

NEW CONCEPT in low-voltage circuit breaker design — providing short-circuit current protection up to 100,000 rms amp — has been developed.

The new circuit breaker uses current-limiting fuses in a standard molded-case circuit breaker — both in a common molded housing no wider or deeper and only a few inches longer than a comparable standard sized breaker.

This unusual union makes possible, for the first time, a compact electrical protector with short circuit interrupting capacity of 100,000 rms amp with all the operational advantages of a circuit breaker.

This new breaker is one solution to the problem of ever-increasing high short-circuit currents facing builders and users of low-voltage (up to 480 v a-c) electrical distribution systems.

Most 600 v molded case circuit breakers have maximum current interrupting ratings of 25,000 amp. Yet with increased distribution voltages and higher concentrations of power in low voltage distribution systems, available short circuit currents of 100,000 amp are not uncommon. To meet this need, this new breaker contains a compact trip arrangement housing current-limiting fuses which extend the interrupting rating of the circuit breaker to 100,000 amp.

If you want more information about this new type of breaker, write to the Editor or write CURRENT-LIMITING FUSE BREAKER on one of the prepaid post cards elsewhere in this issue and mail it to us.

Standard circuit breaker section of this new type breaker contains the conventional thermal trip (for minor overloads) and instantaneous magnetic trip (for all faults below extreme short-circuit currents). Thus the repetitive action of the circuit breaker is retained and replacement need be made only after major short circuit faults which exceed the normal interrupting rating of the standard breaker.

Unusually compact fuse element that makes this new breaker feasible has fusible elements of silver links — either notched or perforated — suspended between two copper blocks and packed in a special quartz sand. The silver and quartz — both having the same melting point — fuse simultaneously under currents of short-circuit magnitude. The fused glass, resulting from the melted quartz, provides a continuous dielectric across the fuse breaks to minimize arcing even under unusually high currents.

Fuse design is such that short-circuit current is completely interrupted in a quarter cycle. Consequently a current limiting effect is achieved which materially reduces the current passed during a short current fault. Thus the resulting magnetic stresses — proportional to the square of the current — and also the heat generated by the short circuit current are kept well within the capacity of the circuit breaker.

Since the current-limiting fuse unit adds, at most, only 3 in. to the overall breaker length, the circuit breaker is a very compact device. For example, the 400-amp frame breaker measures only 19⅝ in. long, 9 in. wide and 5½ in. deep.

Mechanical interconnection between the fuse trip unit and circuit breaker makes it impossible to damage electrical equipment by operating on two phases when the third phase faults to ground. Each fuse contains a spring-loaded plunger that is released when the fuse blows. The plunger in turn actuates the trip mechanism to open all three phases.

This feature makes it impossible to reset the circuit breaker without replacing the blown fuses. It also eliminates the danger of removing fuses under load as the mechanical linkage will trip the breaker before the fuse trip unit contacts are broken.

The spring-loaded fuse plunger further simplifies the process of fault location in the case of short-circuit failure by providing visual indication of the phase that shorted.

For rapid return to service after a major fault, the entire fuse trip unit can be replaced with a loaded standby trip unit in a matter of seconds.

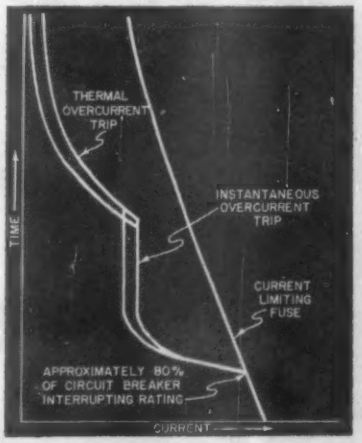
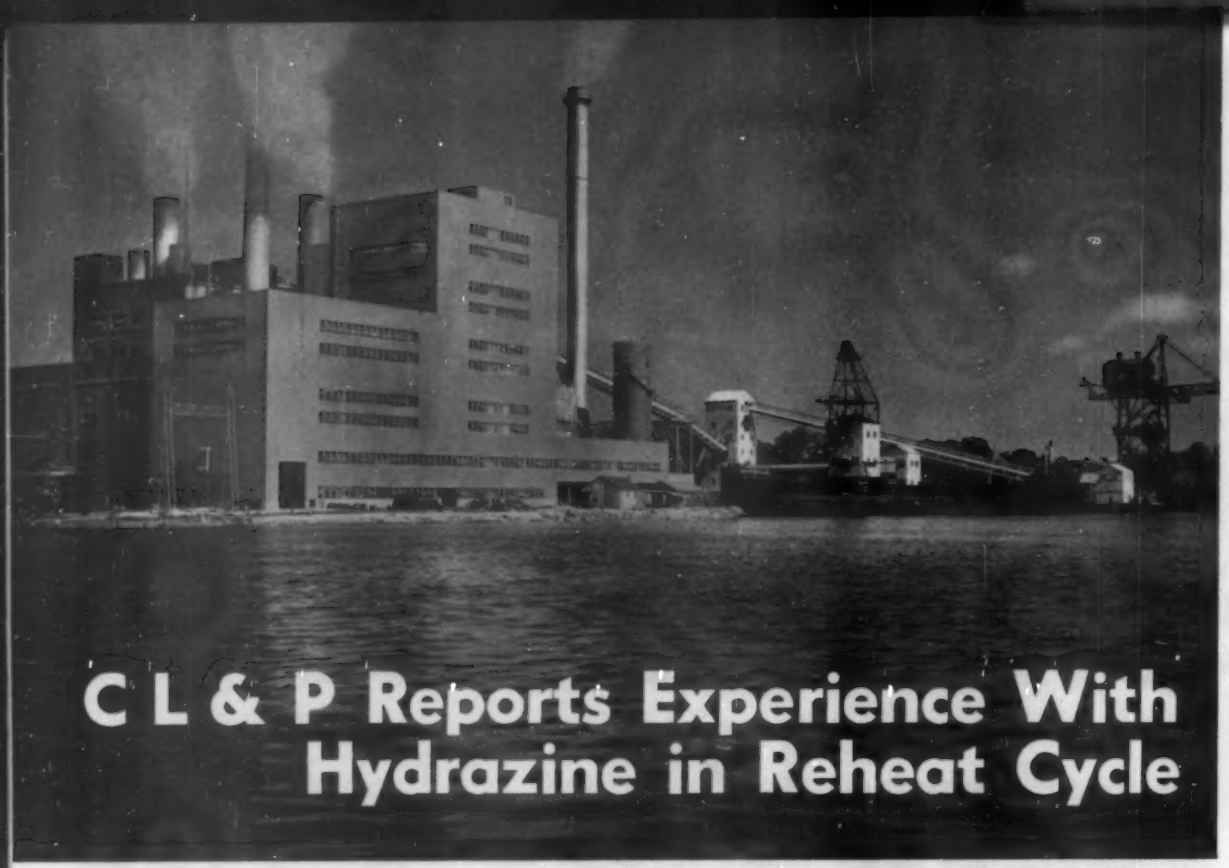


Fig. 3. Breaker unit has thermal and magnetic trips for small faults, current limiting fuses for heavy short circuits



C L & P Reports Experience With Hydrazine in Reheat Cycle

Fig. 1. Connecticut Light & Power is using hydrazine plus sodium sulfite and morpholine in their Montville plant (above) Unit No. 5. It's like wearing both belt and suspenders, but they report excellent results

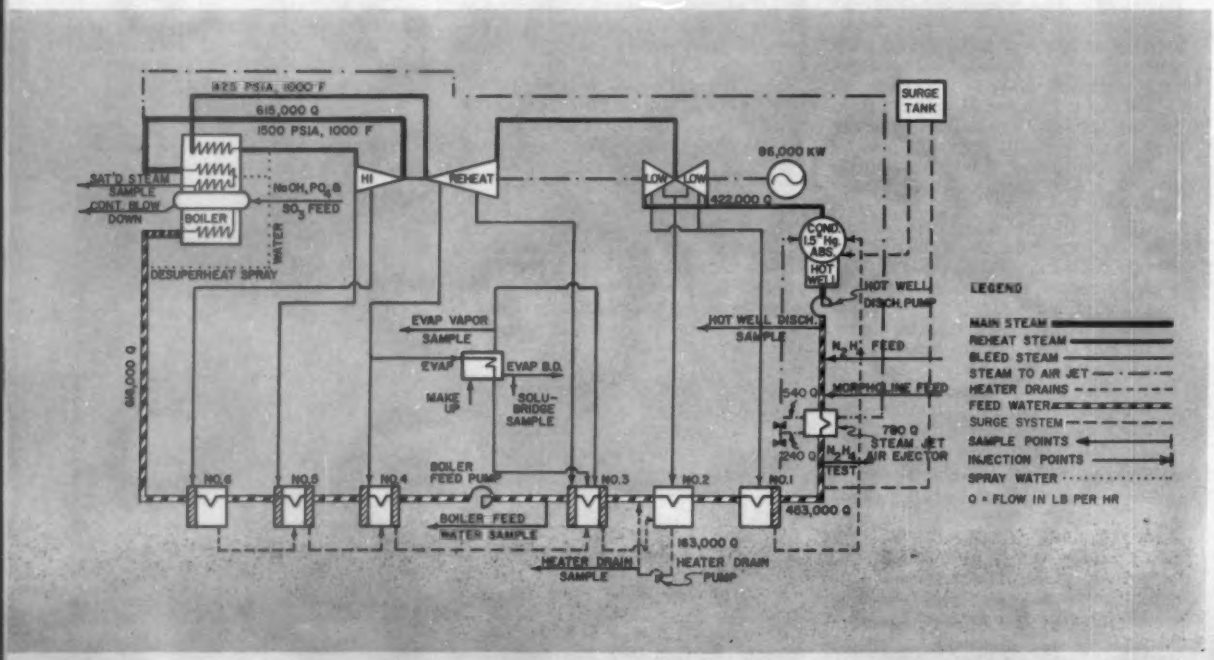


Fig. 2. Feedwater and steam cycle for Montville No. 5 unit, showing the chemical injection and sampling points. System provides injection of NaOH, $-PO_4$, $-SO_3$, hydrazine, and morpholine. See Table I for sampling points and test schedule

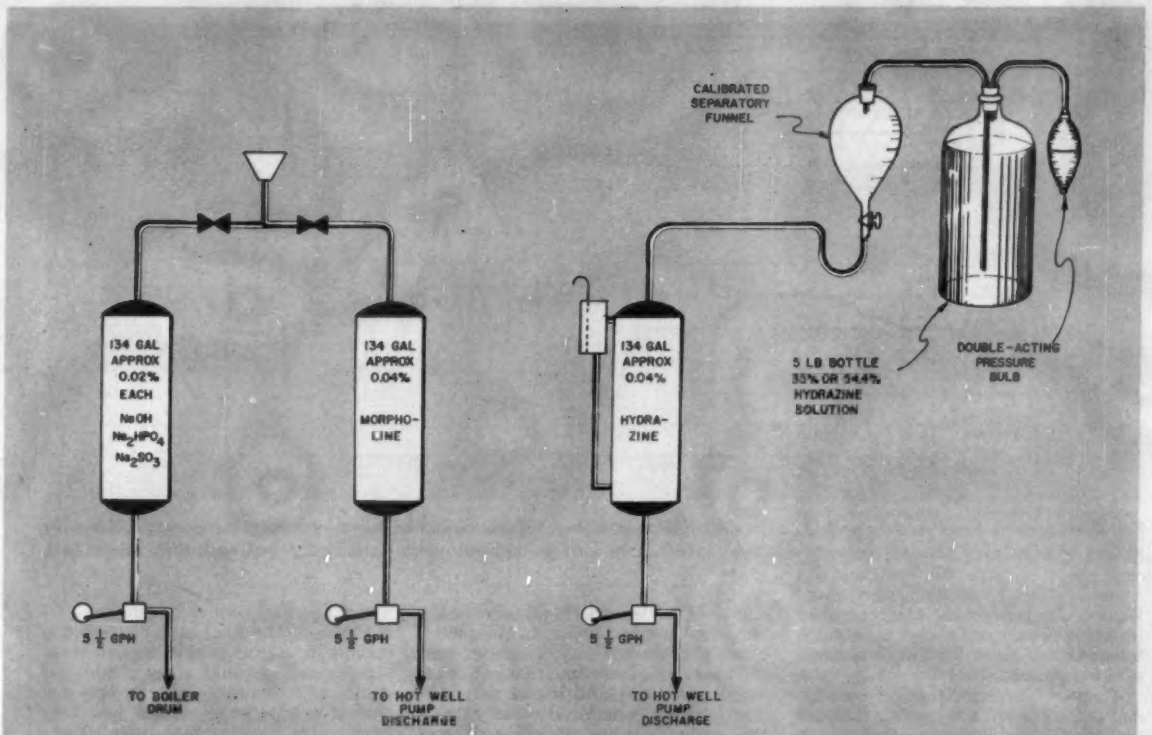


Fig. 3. Original chemical feeding equipment, in which tanks were charged daily and feed pumps operated continuously

By ROBERT T. HESS * and ANDREW W. WOFFORD †

HYDRAZINE and sodium sulfite, used as a team, offer a possible solution to the problem of oxygen corrosion. The purpose of this paper is to describe the unique application of these two scavengers, used simultaneously in a single feedwater-steam-condensate system, and operating data observed during eight months of such treatment. The results have been encouraging, and a similar program is being planned on additional units in The Connecticut Light and Power Company system.

Background

The decision to use hydrazine in the new Montville No. 5 Unit was arrived at following consultation between responsible CL&P personnel and; the designers and erectors, United Engineers & Constructors Inc.; the boiler manufacturer, Combustion Engineering Inc.; and the company's water consultant, Sheppard T. Powell.

Major considerations affecting this decision were:

A. Concern over the possible ineffectiveness of existing chemical treatment, as evidenced by the large amount of metal oxide sludges often found in present-day high pressure boilers.

B. The reluctance to add any solid chemical to the feedwater cycle upstream of the desuperheater water take-off allowing dissolved solids to bypass the steam purifying equipment in the boiler drum and enter the steam cycle.

C. The desire to protect the entire system from oxygen corrosion, which is not accomplished when sulfite is added directly to the drum. Under certain conditions, sulfite also has the disadvantage of decomposing to equally harmful products (references 1, 2 at end of article).

Obviously, no single "miracle chemical" can supply all the answers to these combined problems. Control of the condensate pH by neutralizing amines presents one means of defense. The CL&P had materially reduced metal pick-up in two 1350 psi units with the use of morpholine; still, it was felt that pH control was not enough.

Hydrazine, a volatile liquid and a strong reducing agent, offers another segment of the solution. However, information as to its effectiveness was scarce and often contradictory (3, 4, 5). There was some uncertainty as to whether a residual of hydrazine could be "stored" in the boiler water to handle any sudden air leak. It was hoped that sulfite, used in much smaller quantities than previously, would correct that fault. Evidence shows that the two are compatible (6).

Objectives

Therefore, the combined theory of feedwater and boiler water treatment was to:

1. Condition the boiler water with sodium hydroxide and disodium phosphate, to 10.6–11.2 pH, 5–20 ppm soluble phosphate.
2. Control the pH of the steam, condensate and feed water at 8.9 to 9.1 with morpholine.
3. Scavenge the residual oxygen in the feedwater system with hydrazine.
4. Combat any oxygen that should escape the hydrazine by maintaining the smallest practical residual of sulfite in the boiler drum. This residual of sulfite should also serve as an indication of sufficient hydrazine in the system.

Description

Figure 2 is a single line diagram of the steam and feedwater cycle. It is a closed system with six extraction heaters and a large deaerating hot well of 16,000-gal storage capacity. A tangentially-fired steam generator is designed to deliver 625,000 lbs. per hour super-heated steam at 1500 psi 1000 F/1000 F reheat to a 75,000-kw GE turbine, which exhausts into a 55,000-sq ft C. H. Wheeler condenser.

* Chemist, and † Engineer, The Connecticut Light & Power Company, Berlin, Connecticut.

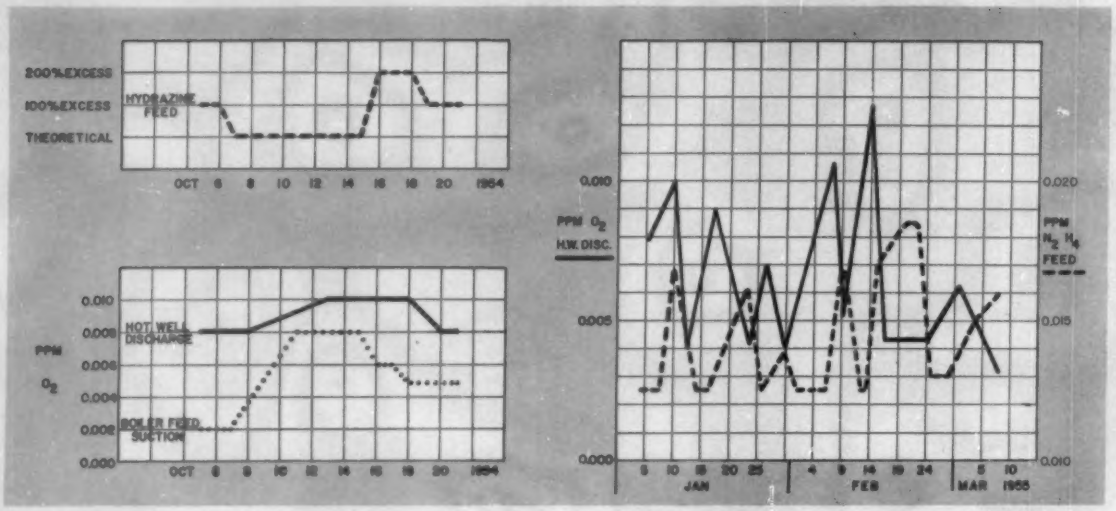


Fig. 4. Hydrazine feed vs. dissolved O_2 before and after injection indicates 100 per cent excess is optimum dosage rate

Fig. 5. Relationship between hydrazine feed and dissolved O_2 at the hotwell pump discharge. Meaning is discussed in text

Figure 2 also shows the chemical injection and sampling points. A tabulation is given for the disposition of each sample.

Original chemical treatment equipment used is shown in Fig. 3. Each tank is charged daily and each pump feeds continuously.

Operation

A caustic boil-out was the only pretreatment of the internal boiler surfaces before start-up. In order to proceed cautiously, the water treatment plan outlined above was applied in degrees, beginning in June 1954.

Phase 1, the first three weeks of operation, consisted of boiler water conditioning only, with caustic and phosphate plus 1 to 5 ppm residual sulfite. The desired chemical concentrations in the boiler water were quickly achieved.

Phase 2, the next three weeks, began with the addition of morpholine for pH control. By the end of this period the desired pH had been established with a feed of approximately 11½ ml 100 per cent morpholine per million pounds of steam.

Phase 3 was the following two-month period when hydrazine was used as the only oxygen scavenging agent, with the elimination of the sulfite. During the first few days of this period, ammonia and conductivity were abnormally high, 0.6 ppm and 6.0 μmhos respectively; but a more desirable range was soon established with a morpholine feed of 7 ml per million pounds of steam and hydrazine feed of 0.019 ppm.

Phase 4, the final and present operating practice, involves maintaining a small residual of sulfite in the drum, 1 to 2 ppm. This requires less than two ounces of sulfite per day. The hydrazine feed is 0.015 to 0.020 ppm and the morpholine feed is 5 to 6 ml per million pounds of steam.

Typical analyses obtained at the hot well pump discharge during these periods are shown in Table II. Results at the hot well are representative of the entire system, with the exception of the oxygen.

Observations

The hydrazine feed has varied from theoretical (equal in ppm to the oxygen tests at the hot well pump discharge) to 500 per cent excess, with the most desirable results occurring at 100 per cent excess, i.e. twice the oxygen at the hot well pump discharge.

At feeds above 50 per cent excess, the oxygen recorders indicated that about half of the oxygen was being removed between the hot well pump discharge and the boiler feed pump suction. In contrast, Fig. 4 shows that with a feed of less than 50 per cent excess, the oxygen at the boiler feed pump suction gradually increased. The scavenging action of the hydrazine had apparently dimin-

Table I. Sampling points vs. type testing being conducted on Montville No. 5 Unit

Sampling Point	Analysis				
	pH	O_2	Conductivity	Degassed Conductivity	Spot
Hot Well Pump Discharge	R	R	R		D, TW, O
Steam Jet Air Pump					
(Feedwater side)					O
(Steam side)					O
Evaporator Vapor			R	R	TW
Evaporator Saline			I		
Heater Drain Pump Discharge	R	R*			D, TW, O
Boiler Feed Pump Suction	R	R			D, TW, O
Boiler Blow Down					B, O
Superheater Inlet	R		R	R†	D, TW, O

Where:
R = Recorded
I = Indicated (Solubridge Controller)
D = Daily Tests for NH_3
TW = Twice Weekly Tests for SiO_2, Fe, Cu, CO_2, pH
O = Occasional Tests for N_2H_4, Morpholine
B = Daily Boiler Water Tests: pH, SO_3, PO_4, P and MO alk, NaCl, Solids, SiO_2

* Two of the O_2 samples are recorded concurrently. A valve arrangement allows the heater drains to be substituted for one of the other two when that point is in question. Occasional checks are made on the O_2 recorder by Schwartz-Gurney tests. The Cambridge analyzer is somewhat affected by hydrazine and its resultant nitrogen. This effect has been studied and found to be a positive error, i.e. recorded values are higher than actual, but they can be and have been corrected.

† The difference in the conductivities is an indication of the ammonia in the system.

Table II. Typical analyses at the hotwell discharge during 4 start-up phases

	μmhos conductivity	pH	ppm NH_3	ppm Fe	ppm Cu	ppm O_2
Phase 1	1.3	8.3	0.06	0.4		
Phase 2	2.7	8.9	.18	.04	0.05	0.016
Phase 3	3.4	9.1	.36	.02	.02	.010
Phase 4	3.0	9.0	.20	.01	.01	.008

Note: term μmhos means micro-mhos.

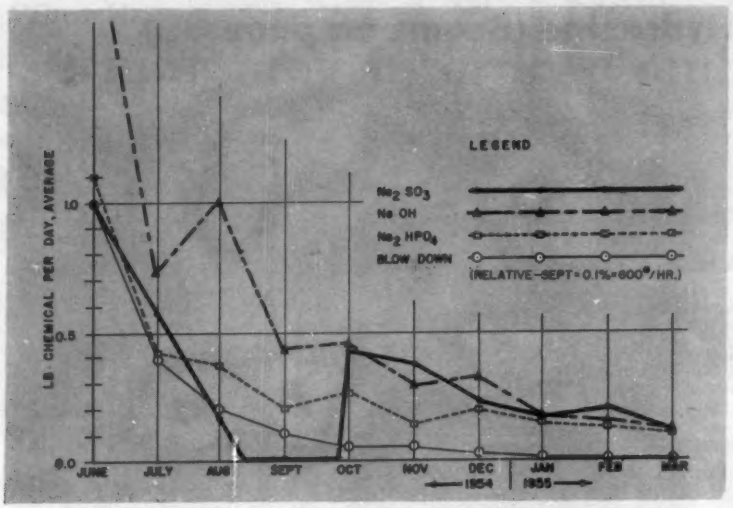


Fig. 6. Quantity of solid chemicals used compared with the corresponding blowdown. Note that blowdown curve is relative, with September '54 as 0.1 per cent

ished, for during the same period a sulfite residual was not achieved, although the sulfite charge was more than doubled. Normal scavenging was again accomplished with an increased hydrazine feed. Thus, it appeared that 100 per cent excess was the optimum dosage rate.

The following formula was devised to enable the plant personnel to determine the daily hydrazine charge:

$$a = \frac{2 \times y}{z} K_1 \qquad (I)$$

Where:

- a = charge of hydrazine in ml per day
- 2 = the desired 100 per cent excess
- x = oxygen reading at the hot well pump discharge in ppm
- y = steam flow in millions of pounds per day
- z = percent hydrazine in the hydrate
- K_1 = 454, the factor to convert lb to ml

Since the unit is usually base loaded at 86,000 kw and 615,000 lb of steam per hour, y is constant at 14.76. For the 54.4 per cent commercial hydrazine solution, z is 0.544. Therefore, Formula (I) can be shortened to:

$$a = 2 \times K_2, \text{ where } K_2 = 1.25 \times 10^4$$

This policy of doubling the oxygen readings at the hot well pump discharge to determine the hydrazine feed at first gave satisfactory results, but observations showed that a definite minimum feed had to be established. Figure 5 shows that the reduction of hydrazine feed to below 0.014 ppm is followed by an increase in the oxygen at the hot well pump discharge. The same effect had occurred several months earlier as shown in Fig. 4, but was not recognized at the time.

Evidence led to the suspicion that hydrazine must be present in the hot well before its injection at the hot well pump discharge. Analytical tests have shown this to be correct. It is a result of recirculating a portion of the hydrazine feed to the hot well by the condensate surge system and the hot well level control. It is suspected that some also re-cycles with the steam for traces are found in the heater drains. This has also been reported by Baker (7).

Normal concentration of hydrazine in the hot well is approximately 0.01 ppm. Thus, as the condensate is deaerated mechanically in the condenser, it is further deaerated chemically in the hot well. Due to its large capacity, condensate is retained in the hot well approximately 15 minutes allowing considerable time for reaction. At reduced loads, the retention time is proportionally increased and the oxygen readings at the hot well pump discharge are at their lowest. This is in contrast to the observations reported by Grabowski (8), where hydrazine was not used.

Comments

The chemical deaeration in the hot well is more dependent upon the concentration of hydrazine built up in the system than on the immediate feeding rate. Where it had been assumed that the oxygen at the hot well pump discharge was the only variable in computing the charge required, it now appears that it, too, can be considered constant; in this case, 0.008 ppm (the expected and observed performance of the condenser).

Hence, Formula I becomes: $a = K_2$ or, 200 ml per day of 54.4 per cent hydrazine solution for this base-loaded unit.

The delayed action effect on the oxygen, observed when changing the feed rate, supports the conclusions Leicester (9) presented in his paper on hydrazine that the reaction of hydrazine depends upon the presence of ferric iron oxide. The ferric oxide film in the feed system is reduced by the hydrazine to the ferrous, which in turn reacts with the residual oxygen in its tendency to go to its highest oxidized state. These reactions may be visualized thus:

$$N_2H_4 + 2Fe_2O_3 \longrightarrow 4FeO + N_2 + 2H_2O \qquad (II)$$
$$4FeO + O_2 \longrightarrow 2Fe_2O_3 \qquad (III)$$

When the hydrazine feed is decreased to below the amount required to reduce the constant amount of iron surface in the system (regardless of the oxygen present) as in reaction (II), reaction (III) diminishes. However, the latter reaction continues long after the cessation of the hydrazine feed, since there is considerable iron surface in a unit of this size.

The calculated 200-ml-per-day charge is the amount necessary to maintain the "hydrazine equilibrium" in the system by replacing that which is used up in reaction and/or decomposition. This is borne out by the operating data shown in Figs. 4 and 5.

In one series of experiments before the build-up of hydrazine in the system, the oxygen recorder at the boiler feed pump suction indicated normal scavenging many hours after a Haller electrode (10) showed the complete absence of hydrazine. In case of an unusual occurrence, such as an air leak or chemical pump failure, the system is protected until the routine tests reveal the situation.

Therefore, some of the major objections and uncertainties concerning the use of hydrazine have been investigated and placed in their proper perspective:

Existing equipment was all that was necessary to begin its application.

Routine analysis, by paradimethylamino-benzaldehyde (10a, 11) and the Haller electrode, is unnecessary since the sulfite residual is a more convenient control.

Excessive ammonia is not added to the system, as it can be removed by the mechanical vacuum pump or by intermittenly dumping overboard the after-condenser drains from the steam jet air ejector.

Time for reaction is much longer than at first contemplated, since hydrazine builds up in the system.

Additional protection is achieved by the "fly wheel" effect of the hydrazine-iron oxide-oxygen reactions plus the second line of defense afforded by the sulfite.

Although hydrazine must be treated with respect, handling precautions are not impractical (12). Information concerning the use of this chemical can be obtained from the manufacturer.

Visible Results

The alkaline nature of both hydrazine and morpholine has contributed to reducing the demand for solid chemicals in the boiler, and has consequently decreased the blow down. On a monthly basis, Fig. 6 shows the average daily charge of

C L & P Reports on Hydrazine (Begins on page 80)

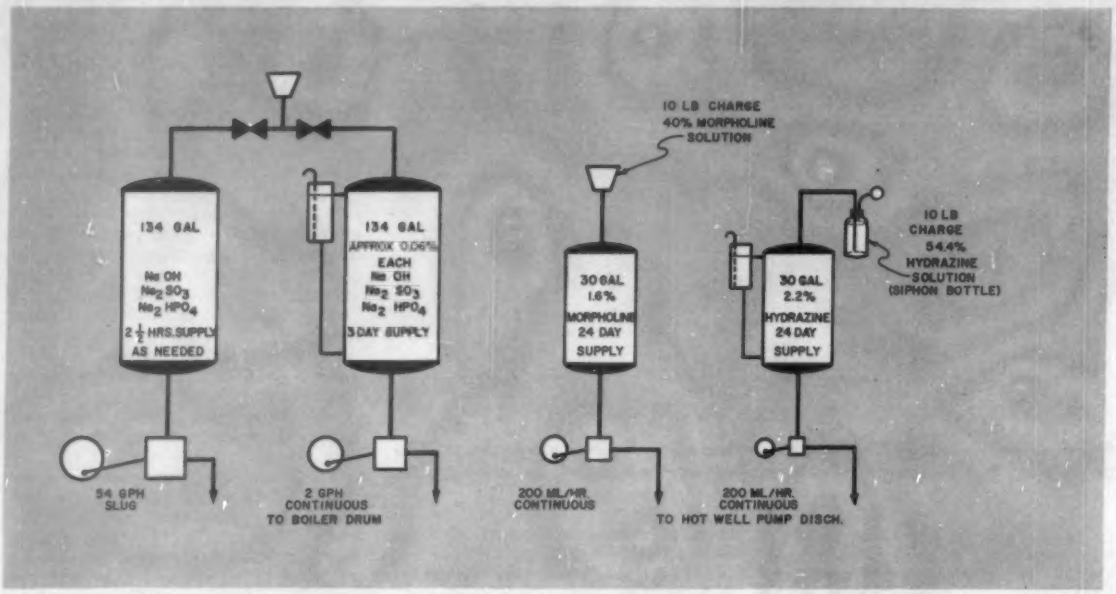


Fig. 7. Revised version of chemical feeding equipment which requires less frequent recharging and less operator attention

each solid chemical and the blow down history for this unit. The blow down is based on a maximum of 2 ppm silica in the boiler water.

All chemical requirements have leveled to a constant amount. Whereas the original feeding set-up involved varying daily charges, the chemical demand can now be anticipated, allowing the solutions to be made up less frequently, requiring less operator attention. Figure 7 shows the revised pumping arrangement.

The boiler internals have been visually inspected twice since start-up with pleasing results. The drum was vacuum-cleaned and the deposits analyzed (see Table III).

A water hosing of the turbine rotor was all that was necessary to remove a loose amorphous deposit, 90 per cent SiO_2–10 per cent Fe_2O_3, from the last row of blades in the reheat section. The desuperheat sprays have been used more than expected due to excessive boiler reheat surface, a condition which has since been corrected.

Conclusions

1. Hydrazine can be used successfully as an oxygen scavenging agent.

2. Simultaneously, a small sulfite residual can be carried as a safety measure; however, its major role is that of a convenient indication of sufficient hydrazine.

Table III. Drum deposit analysis results

Date	Weight	% Fe_2O_3	% Cu
10/30/54	14#	88.1	2.8
3/30/55	10#	79.2	17.1

3. A point of "equilibrium" can be established throughout the system wherein the hydrazine concentration becomes more or less constant.

4. Some chemical deaeration occurs in the hot well when this condition of equilibrium is maintained.

5. Optimum hydrazine feed to maintain this equilibrium is approximately 100 per cent excess. However, a definite minimum feed should be set since the oxygen reading at the hot well pump discharge may give a false indication of the deaerating qualities of the condenser.

6. Hydrazine contributes to the pH in the boiler, resulting in less caustic feed and, therefore, less solids in the boiler water.

7. Plant personnel versed in the older methods of treatment can quickly adapt themselves to the feeding and testing procedures.

8. The conductivity, pH and oxygen recorders are invaluable tools in analyzing conditions in the feed water-steam-condensate system.

9. No special chemical mixing or pumping equipment was necessary to begin its use.

10. The use of hydrazine adapts itself nicely in a new unit design, since the chemical equipment can be smaller and less cumbersome than at present.

11. The use of such small amounts of sulfite does not add appreciable solids to the boiler or its decomposition products to the steam.

12. The dual use of hydrazine and sulfite tends to overrule most of the objections raised to the use of either one of the materials separately.

13. It should be noted that the results reported in this paper were achieved on a base loaded unit employing a large hot well and closed heaters.

14. By employing proper safety precautions in the handling of hydrazine, no difficulties have been encountered.

References

(1) The Quality of Steam Condensate Related to Sodium Sulfite in the Boiler Water, by R. C. Alexander and J. K. Rummel. *Transactions, A.S.M.E.*, Volume 72, 1950, pp. 519–527.

(2) Prevention of Metal Losses in the Wet Steam Areas of Steam Turbines, F. L. Archibald, et al., *Proceedings, American Power Conference*, Volume XV, 1953, pp. 579–587.

(3) Experience with the Use of Hydrazine as an Oxygen Scavenger in High Pressure Boilers, by E. C. Fiss, *American Power Conference*, Vol. XVI, 1954, p. 651.

(4) Hydrazine: New Aid to Water Treatment, by E. R. Woodward, *Power*, Nov. 1953.

(5) Comparison of the Action of Ammonia, Amines, and Hydrazine, etc., by F. G. Straub, *Proceedings of the 14th Annual Water Conference*, Engineers Society of Western Pennsylvania, 1953, pp. 90–93, p. 111.

(6) *The Chemistry of Hydrazine*, Audrieth, L. F., and Ogg, B. A., John Wiley & Sons, Inc., New York 1951, p. 143.

(7) Hydrazine as an Oxygen Scavenger — A Progress Report on Tests at Springdale Station, by M. D. Baker and V. M. Marcy, Preprint 54-A-261, A.S.M.E. Annual Meeting, Nov. 1954.

(8) Problems in Deaeration of Boiler Feedwater, by H. A. Grobowski, et al., *Combustion*, March 1955.

(9) The Chemical Deaeration of Boiler Water — The Use of Hydrazine Compounds, by J. Leicester, Preprint 54-A-123, A.S.M.E. Annual Meeting, Nov. 1954.

(10a) Hydrazine Finds New Fields: Industrial Plants, by R. V. Montville, et al., *Power*, March 1955.

(10b) Amperometric Analyzer, by J. F. Haller (to Mathieson Chem. Corp.) U. S. Patent 2,651,612, Sept. 8, 1953.

(11) A Spectrophotometric Method for the Determination of Hydrazine, by G. W. Watt and J. D. Chrisp, *Anal. Chem.*, Vol. 24, 1952, pp. 2006–8.

(12) Charles C. Clark, *Hydrazine*, Mathieson Chemical Corporation, Baltimore, Maryland, 1953, pp. 110–113.

What Happened to the

Humphrey Internal Combustion Pump?

We engineers become so preoccupied with modern engineering developments that we tend to forget ingenious developments of the past. For example, this high-volume pump used a column of water as the piston, had no moving parts but valves, and had internal cooling

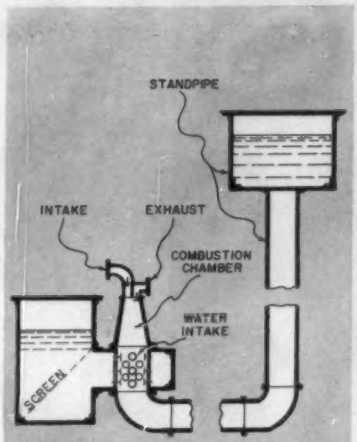


FIG 1

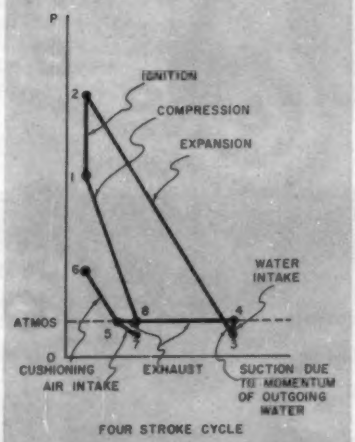


FIG 2

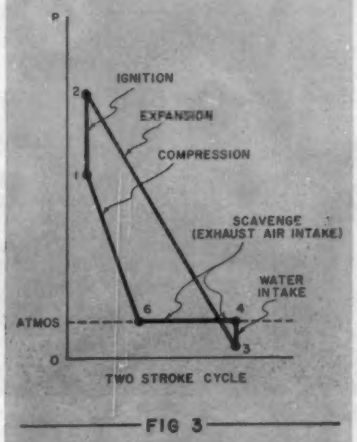


FIG 3

ENGINEERING has certainly changed in the last generation. We have high-speed calculators, specialties within specialties, new materials to work with, and financial backing with both public and private funds. One thing has not changed through the years, however, and that is the ingenuity of individuals. We might well look at the past to see what this ingenuity has produced, and what might be re-evaluated in terms of today's knowledge.

As a case in point, we have selected the "Humphrey internal combustion pump," which has been built in sizes up to 40,000,000 gal per day. It has been used in irrigation work and in mine de-watering, and possibly other applications have been made that we have not heard of.

Figure 1 shows the extreme simplicity of construction in the i-c pump. It has no moving parts, except its valves, and uses a water column as a piston. Cooling is internal since the water column passes over most of the surfaces heated by combustion gases. The i-c pump, like an i-c engine, can operate either on the four-stroke or two-stroke cycle (Figs. 2 and 3, respectively). Of course, the two-stroke cycle requires auxiliary equipment not shown in Fig. 1, which somewhat offsets the advantage of simplicity.

Beginning with ignition of the gases, the four-stroke cycle works like this:

(a) Ignition, followed by pressure build-up (1–2) until the water column begins moving.

(b) Expansion (2–3) of the gases, forcing the water column out of the combustion chamber and up the standpipe.

(c) Momentum of the water moving out of the combustion chamber causes the water to rise in the standpipe beyond a point of static equilibrium and pull a partial vacuum (4–3) in the chamber. At this point a fresh charge of water is drawn in from the water box through the valves (3–4), the exhaust valve opens, and a combination of fresh water and the return from the standpipe rise in the chamber (4–5) until the exhaust valve closes (5).

(d) Momentum of the water column moving back into the chamber compresses the remaining gas (5–6), which reverses the water flow after equilibrium is reached (6–5–7).

(e) Momentum of flow out of the chamber pulls partial vacuum (5–7) as the gas inlet valve opens to admit a fresh gas charge (7–8).

(f) Once again, the direction of flow reverses and the full weight of the water column plus its momentum compresses the fresh gas mixture in the chamber (8–1).

(g) Cycle repeats, starting with ignition (point 1).

Two-stroke cycles are less complicated, but the equipment requirements are more involved. One means of obtaining two-stroke operation would be to employ a blower and separate drive, but another method calls for a weighted piston that induces a fresh charge of air and gas when it falls. While this is more expensive than the four-stroke machine, it would pump nearly twice as much water and would probably be cheaper "per gpm" than its predecessor. It is also likely, since much of the fluid friction is eliminated through reduced strokes, that the efficiency would improve. Other improvement is possible. Figure 3 is a pressure-volume diagram of the two-stroke cycle, which is similar to the four-stroke cycle excepting the suction stroke (8–5–6–7–8, Fig. 2).

Advantages ascribed to such an engine-pump are simplicity, low first-cost, low maintenance, integral cooling, and acceptable over-all thermal efficiency of 22 to 23 per cent. Low cost would be a compelling reason to consider such pumps for modern flood protection service, which calls for long idle periods followed by periods of high-capacity service. Low cost plus simplicity and low maintenance would seem to make such a pump very desirable for irrigation service where natural gas fuel is available and the primary water source is on the surface (rivers, lakes, etc.).

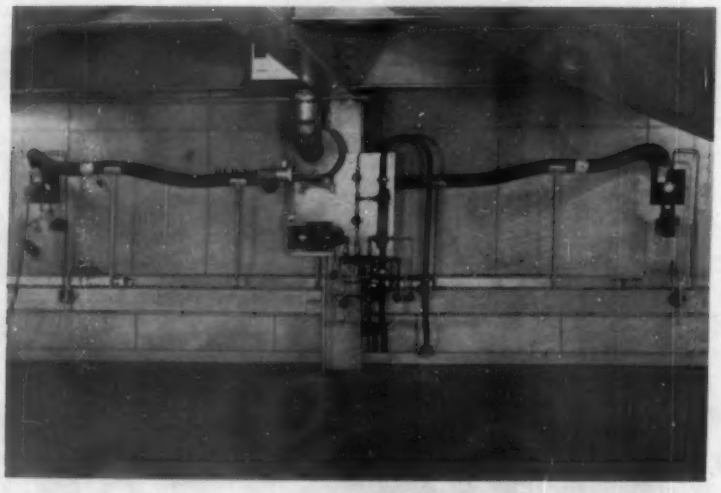
Our questions to you readers are: Have you heard why the Humphrey pump dropped from the scene? What are its disadvantages? Has an actual installation of the two-stroke cycle pump been made? (The 40-mgd, 30-ft-head units installed at Chingford Reservoir in London were on the four-stroke cycle.) Have any recent experiments been conducted toward extending the use of these pumps?

If you know the answers to any of these questions, or have other comments on the Humphrey pump, we would like to hear from you. Also, if you know of another old development which showed promise but later dropped from sight, we would like to hear about it.

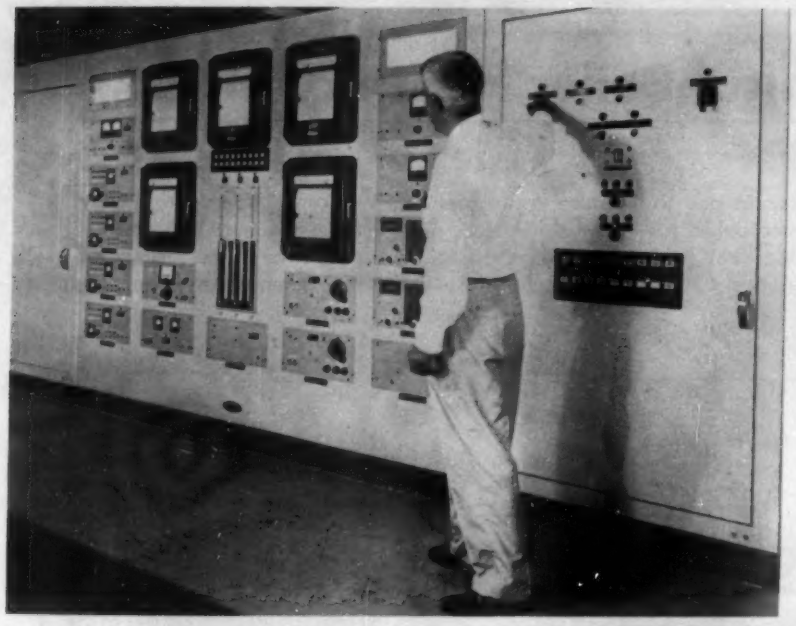
Slightly unconventional, Cleveland Electric Illuminating Co.'s new 260,000-kva generator boasts liquid cooled stator conductors and is largest of this type. It will go in the Eastlake plant which is already operating three 125,000-kw units. Arrows show coolant taps

News Reel

First tower steel goes up for Mackinac bridge which, when completed, will be world's longest suspension bridge. No lightweight, the tower will weigh about 6960 tons and peak at 552 feet height

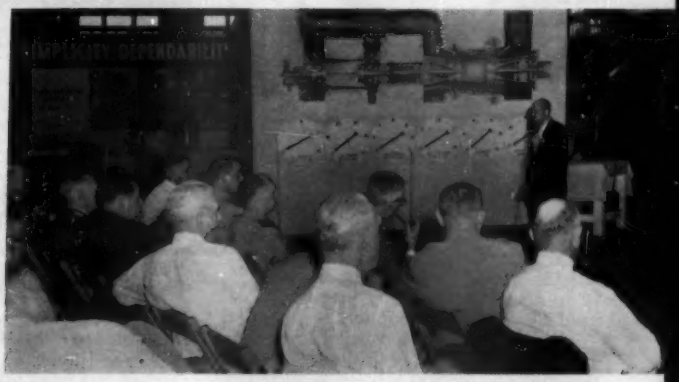


PG & E's Contra Costa plant televises front oil and gas burners through rear water-cooled windows in power boiler

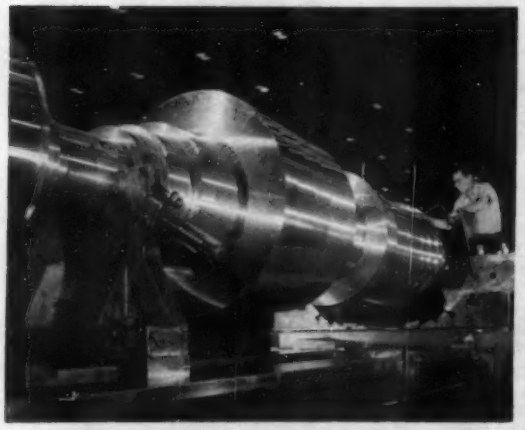


Leeds & Northrup get into the Geneva act with this control panel for the new swimming-pool reactor. Oak Ridge Lab will operate the reactor at Geneva. It is brought up to rating manually, then is taken over by automatic equipment

Jersey Central P & L gets a double-rush replacement for a fire-damaged transformer at Summit, N. J. The 5000-kva unit was built from scratch in five days by GE in their new Rome, Ga. facility



Government and military brass get a demonstration of Clark Bros.' 5500-kw mobile gas turbine. Dials in background repeat board readings during operation



Turbine rotor for high pressure element of 260,000-kw steam turbine-generator being machined on a grooving lathe. Unit is for Detroit Edison Co.'s new River Rouge Station. It will be of cross-compound, double-flow, reheat design

Part of a hot-bed — catalytic bed, that is, which converts refinery waste gas into a hot stream that generates 50,000 lb steam per hr in an overhead boiler. Ten thousand individual units make bed

Graphical Boiler Heat Balance

By PAUL J. GROGAN *

Losses due to moisture in the fuel (which goes up the chimney) were accounted for in the April issue, page 78. Loss due to hydrogen in the fuel (which also goes up the chimney) was discussed in the August issue, page 80. But here is the big chimney loss—dry gas

5. Loss Due to Dry Flue Gases

LOSSES due to the heat in dry flue gases assume major importance in heat balance work. No other heat loss is so large. No other heat loss is so readily subject to control.

The idea of a loss due to the dry flue gases is easy to grasp. The proper combustion of coal requires from 8 to 15 pounds of air, depending upon the fuel and the fuel-burning equipment. Efficient combustion of oil or gas requires from 15 to 20 pounds of air per pound of fuel. In any combustion process, a large amount of air is taken in at low temperature, combined with the fuel in combustion, passed over heat recovery surface, and discharged to the atmosphere at a temperature from 200 F to 500 F above the original condition. If not kept under control, the dry flue gas loss can consume half of the initial fuel energy. However, good practice requires that no more than 10 to 15 per cent of the fuel energy need escape in this manner.

"Dry" is associated with this item of the heat balance for very good reasons. The several sources of moisture in the combustion gases have been discussed in earlier heat balance articles. Certain losses due to moisture in the stack gases involve the latent heat of vaporization. This term is quite large on a pound basis and should be kept entirely apart from calculations considering only sensible heat additions to the flue gases. By treating all moisture items separately, there is no possibility of overlooking the sizeable heat additions to vaporizing the liquid.

Furthermore, classical gas analysis methods result in a determination of the volume relationship of the so-called "dry flue gases." The pounds of dry flue gas per pound of fuel are determined from the dry volumetric flue gas analysis. It therefore becomes both necessary and convenient to express the dry gas loss independently of all moisture items.

Determining the dry gas loss per pound of fuel depends upon evaluating the following two terms:

$$\frac{\text{pounds of dry gas}}{\text{pound of fuel}} \text{ and } \frac{\text{Btu carried away}}{\text{pound of dry gas}}$$

The first item may be calculated from the gas and fuel analyses. The second is expressed in terms of an average specific heat and difference between gas and air temperatures.

Loss due to the dry flue gases is represented by:

$$Q_{dg} = \frac{C_b(700 + 4CO_2 + O_2)}{3(CO_2 + O_2)} \times 0.24\,(T_{gas} - T_{air})$$

Where,

Q_{dg} = loss due to dry flue gases, Btu per pound of fuel

C_b = pounds carbon burned per pound of fuel (See POWER ENGINEERING, February 1955, for method of determining this item.)

CO_2 = per cent carbon dioxide, dry volumetric flue gas analysis

CO = per cent carbon monoxide, dry volumetric flue gas analysis

O_2 = per cent oxygen, dry volumetric flue gas analysis

T_{gas} = flue gas temperature, degrees Fahrenheit

T_{air} = combustion air temperature, degrees Fahrenheit

Everything *before* the multiplication sign on the right hand side of this equation expresses "the pounds of dry flue gas per pound of fuel." The remaining information to the *right* of the multiplication sign expresses "the Btu carried away per pound of dry flue gas." The multiplication sign operates upon the physical dimensions of the information as well as the numbers involved. Dimensionally, the product (Q_{dg}) reads "the Btu carried away per pound of fuel."

This equation suggests two methods of control. The dry gas loss may be decreased by reducing the pounds of dry gas per pound of fuel or by decreasing the temperature at which the gases are discharged. Surface cleanliness and the reduction of baffle leakage will serve to reduce the exit gas temperature. Control of excess air to the desirable minimum usually offers the greatest opportunity for improvement.

A reduction of mass flow per pound of fuel produces a saving with respect to each multiplying factor of the dry gas loss. Fewer pounds of gas per pound of fuel are a direct saving. Lower gas temperatures for lower mass flow are an indirect saving. Since heat transfer is proportional to the mass flow raised to the 0.6 to 0.8 power, a 20 per cent reduction in mass flow results in an approximate 15 per cent reduction in surface heat transfer rates. Each pound of gas enjoys 20 per cent longer exposure to the heat transfer surface due to the lower velocity. The net result is approximately 5 per cent more heat transferred per pound of gas, or lower gas temperatures.

Dry gas heat loss can be found graphically with the accompanying construction. The oxygen variable has been eliminated from the graphical solution by assuming that:

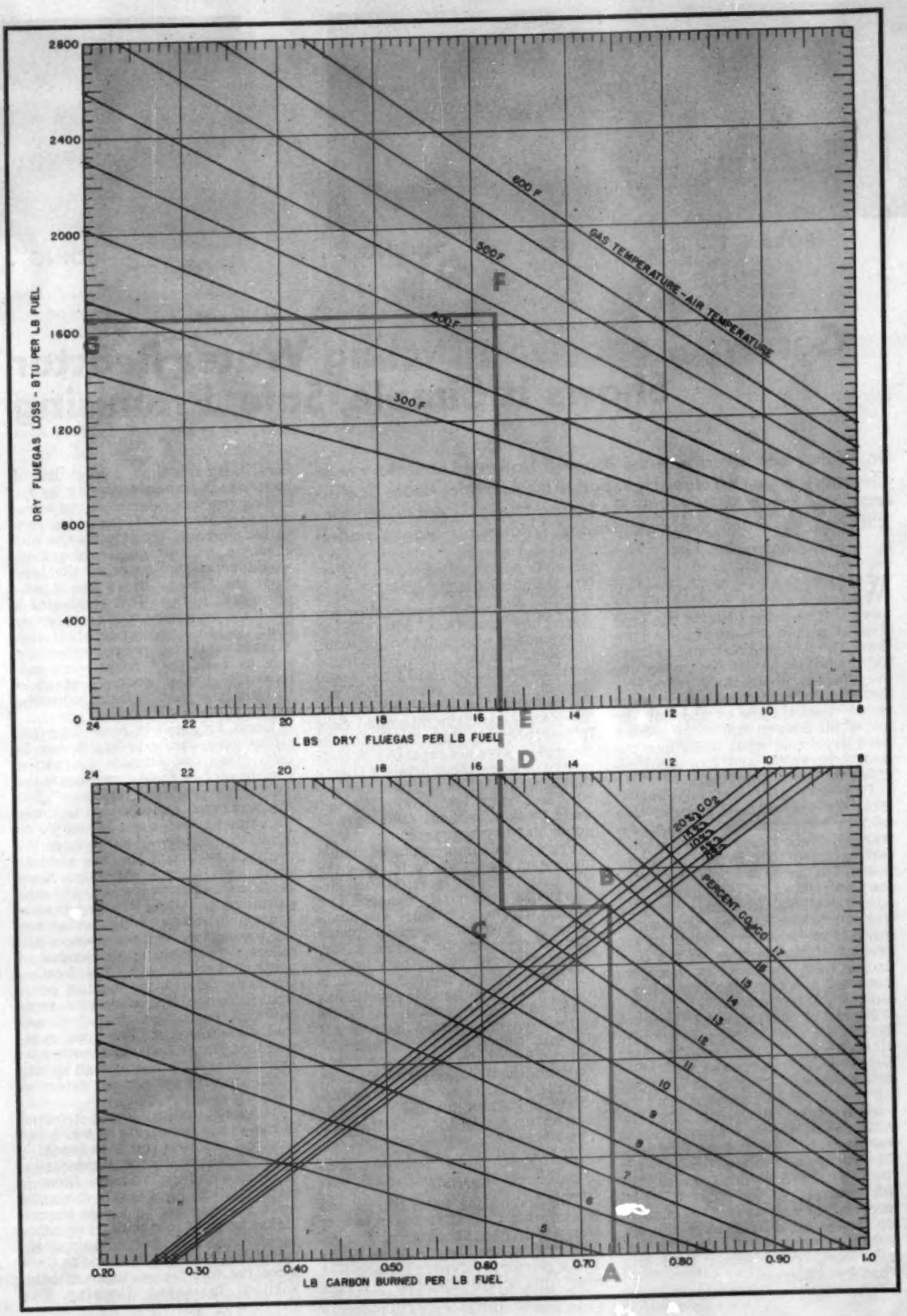
$$O_2 = 18 - CO_2$$

This approximation may be slightly in error when burning natural gas with low excess air. However, a 20 per cent relative error in the above approximation results in but one-half of one per cent error in the result.

Example 1: Pounds carbon burned per pound of fuel equals 0.74 (enter chart at A). The per cent carbon dioxide in the dry volumetric flue gas analysis is nearly 12.0. Carbon monoxide is but a trace (move up to point B, left to point C, and up to point D). Read result of 15.4 pounds of dry flue gas per pound of fuel. Given combustion air and flue gas temperatures of 50 F and 500 F, respectively, find the Btu loss per pound of fuel. Enter the upper half of the chart at 15.4 pounds of dry flue gas per pound of fuel (point E). Move upward to the line representing 450 F *difference* between gas and air temperatures (point F). At the left (point G), read the loss as being 1,665 Btu per pound of fuel.

Example 2: A more modern installation might burn the same fuel and produce 14 per cent carbon dioxide. The reader should check the construction, as in Example 1, to find 13.4 pounds dry flue gas per pound of fuel. If the gas temperature is reduced to 300F by better heat recovery, the dry gas loss then becomes 800 Btu per pound of fuel for the same combustion air temperature.

* Chairman, Department of Engineering, and Director of Engineering Institutes, University Extension Division, University of Wisconsin. All re-publication rights reserved by author.


DRY FLUEGAS LOSS - BTU PER LB FUEL
2800
2400
2000
1600
1200
800
400
0
600 F
500 F
400 F
300 F
GAS TEMPERATURE - AIR TEMPERATURE
G
F
E
D
C
B
A
24
22
20
18
16
14
12
10
8
LBS DRY FLUEGAS PER LB FUEL
20% CO2
15%
10%
5%
PERCENT CO2
17
16
15
14
13
12
11
10
9
8
7
6
5
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.0
LB CARBON BURNED PER LB FUEL

BORAX I . . .

GOING . . .

GOING . . .

Geneva Report on Boiling Water Reactor Shows It Simple, Safe, Promising

Dr. Walter Zinn, director of the Argonne National Laboratory near Chicago, gave an encouraging report to the Atoms for Peace Conference at Geneva Switzerland: The boiling reactor is stable, economical, and has been thoroughly tested. Watch for bigger models

WHAT HAPPENS when an atomic power reactor "runs away"? This little question has kept a lot of people concerned for a long time. The Argonne National Laboratory found out part of the answer unintentionally about three years ago. Since that time they have taken some rather drastic steps to find out the rest of the answer, and in the process have developed what looks like the most economical and fool-proof reactors for power production.

The story goes that on June 4, 1952, an inexperienced operator was working with a so-called "zero-power reactor." Such reactors are designed and operated to generate no excess power, but to idle at a point where the reaction is barely self-sustained. This operator wished to change the control rod, which controls the rate of reaction in *inverse* proportion to the amount of its insertion in the pile. In this case, the fuel elements were immersed in water which served as a coolant and moderator.

Instead of inserting safety rods before pulling the control rod, in order to make the change, this operator blandly pulled the control rod first — which compares roughly with throwing a bucket of gasoline on the kitchen stove. Within a very few milliseconds, the zero-power reactor was generating 360,000 kw in steam. The really interesting part of the story is that it stopped there. Had this been one of the other types of reactors currently in use, the chances are that it would not have stopped before everyone in Chicago, a few miles east, had a pretty good idea what was going on.

Argonne Lab became very interested in this self-quenching phenomena. They were faced with the job of explaining why it did not blow up, deciding whether the experiment could be duplicated, and what would happen when the control rod was drawn out at faster and faster rates. They were especially interested since it was obvious that the insurance companies were not eager to risk their money on some other person's theory that a total run-away could not occur, and very few power reactors could be built without some form of public liability insurance.

Prior to this impromptu excursion into steam generation techniques, the water surrounding reactor fuel elements was deliberately changed fast enough to prevent boiling. The possibility of unstable operation when the water moderator became a turbulent mass of steam bubbles did not encourage anyone to try it. It is likely that the actual experiment would have been years in the future had not one preoccupied operator got the cart before the horse. After he had conducted the initial experiment for them, the Argonne people decided to build a reactor specifically to boil off the moderator (in this case, common water) and test it to destruction. This seemed the best way to find out what they actually had.

Borax I

This first boiling water reactor was built during 1953 at an Idaho testing site which had no close neighbors. The reactor was designated as Borax I (the reactor involved in the accident was unofficially dubbed "Borax Zero"). By this time, a great deal of hope was beginning to spring up for boiling reactors because of the economy they promised. If the steam were to be generated directly on the fuel elements, no heat exchanger system would be needed to carry the heat from the fuel to the water it was ultimately to boil. This eliminated a lot of the most expensive components from the atomic power plant. If such a plant could be proved extremely safe as well, they might very well have the sort of reactor that could be built in or near cities or industrial plants.

Borax I figured in more than 200 safety experiments before it was finally given the ultimate destruction test. In each of these experiments the reactor was made to "run away", but this was much easier said than done. The function of a moderator is to diminish the speed of and bounce the neutrons back into the fuel element when they escape. Without these neutrons the fission would not be self-sustaining so the reaction would slow down and/or stop. Since water was the moderator, and since steam will reflect a relatively small number of neutrons back into the fuel, heating the water above the boiling point would change the moderator from one that encouraged fission to one that discouraged it. The main question that Borax I was to answer was: Does steam form fast enough during a run-away to prevent an explosion — of the A-bomb type?

The most critical factor involved in run-aways is the rate at which the control element is withdrawn— either intentionally or accidentally. If it is withdrawn slowly, there is plenty of time for steam to form and limit the reaction to a safe though higher level. If it is withdrawn more rapidly, there is an infinitesimal interval before steam has time to form when the fuel fissions exponentially, without increased damping. The

GONE!

Borax I blows up—but more like a boiler than an A-bomb. In above photo, explosion was at its peak

Typical result of the "excursions" preceding the total destruction test is shown above at right. Steam forming on fuel plates forces water up and out of reactor tank. The same steam allows the loss of neutrons on which chain reaction depends

faster it is withdrawn, the more complete can be the fission before it is slowed down.

Fuel in Borax I consisted of an assembly of plates made of enriched uranium and aluminum. Five neutron-absorbing control rods engaged this assembly; one of them was specially mounted on strong springs (a working reactor would never have this feature) so that it could be shot down and out of the fuel very rapidly to cause run-away. The reactor itself was buried in the ground within an outer tank which was open, and earth was piled around the projecting part as a radiation shield. A control trailer a half-mile away was connected to the reactor by cables.

In each test, all the control rods but the one spring-loaded rod were withdrawn almost entirely (these are called shim rods). The reactor would become critical and begin releasing energy at a normal rate. Then the spring-loaded rod would be shot out the bottom of the fuel assembly at a known rate of withdrawal, allowing run-away operation until the self-generated steam stopped it and reduced the reaction to a lower level. After an interval long enough for the reactor to stabilize, the shim rods would drop into the fuel core and stop the experiment.

At first, energy release jumped ten-fold in 0.05 second. Later relocations of the shim rods and adjustments in the number of fuel elements in the core increased the rate to a ten-fold jump in 0.01 second. The only results of these tests were the expulsion of water from the reactor vessel and some mechanical damage to the fuel plates. The maximum fuel plate temperature attained was 640F.

Borax I was deliberately destroyed on July 22, 1954, by ejecting the spring-loaded rod in about 0.2 second. The rod was only about 80 per cent out when the reactor peaked at a rate of about 10,000,000 kw. The series of photographs above show what happened. The explosion, while it destroyed the reactor, was limited to the equivalent of a few *pounds* of TNT — hardly what you would expect of an atomic explosion. Most of the fuel fragments landed within 200 feet, and the radioactive fallout was not appreciable beyond a few hundred feet.

It is important to stop at this point and emphasize one thing: These run-aways were forced; they could not occur through the accidental dropping-out of one or all of the control rods. Gravity alone could not possibly remove the rods fast enough to cause a run-away, since steam would form long before they left the fuel core and thereby suppress the reaction through loss of neutrons.

Borax II

Thus the inspired accident of Borax Zero and the confirmations of Borax I led to the construction of Borax II, a legitimate power reactor with a thermal rating of 15,000 kw. This unit has been operating in Idaho since June 28, 1955, driving a condensing 3500-kw turbine generator unit. Net power production in this unit is 2000 kw. On July 17, for over an hour, all power used by Arco, Idaho, came from this atomic plant.

Common water is used as the coolant and moderator and, of course, for conversion to steam. Heavy water would be more desirable technically since it requires less dimensional accuracy of the assembly, but light water is adequate and it costs but a small fraction of the heavy water cost. This water should be treated to produce an extreme purity — at least one megohm. Scaling would increase the fuel temperature needlessly for any given power level and limit the life and performance of the elements.

The Borax II reactor consists of 87 fuel elements made up of aluminum-enriched uranium (about 90 per cent) plates suspended in a 4½-ft-diameter stainless steel tank 16 ft high. Twelve kilograms of uranium 235 comprise the fuel charge. Four blade-type boron and hafnium shim rods and one central cross-shaped cadmium control rod provide the control. The entire reactor core assembly may be removed through the top.

In operation, Borax II is made critical by the partial withdrawal of the control rods. The power level is then brought up to about 1000 kw, at which point the water will be boiling in the core. The temperature and pressure rise steadily, but the power level remains constant and smooth. Reactivity drops because of the increased temperature and it becomes necessary to pull the rods out a bit further, slowly, to compensate for this loss. The steam valve is not opened until the operating pressure and temperature are reached. Steam produced during turbine operation is about 98 per cent dry, so separators are used. Radioactivity of the steam, with a life of only 3–5 seconds, is quite low due to its low starting point, quick decay, and low density of the steam.

Commonwealth Unit

Commonwealth Edison of Chicago is planning a 180,000-kw plant similar to the Borax units, and another of the Borax family is being built on the grounds of the Argonne National Laboratory. This unit is to generate 5000 kw and is to be a small-scale model of the Commonwealth unit. The simplicity of construction, ease and safety of operation, and low cost indicate these smaller units (using enriched uranium fuel) are well suited to remote utility plants or for use with industrial or mining operations. The Commonwealth unit should indicate the practical upper limits of size. Superheating will undoubtedly be added to the larger units and many of the small ones.

Save Money With Color

In July the author, well-known authority on use of color in industry, explained how proper use of color reduces accidents. Now he quotes figures to show money actually saved by use of functional color

By FABER BIRREN*

FUNCTIONAL COLOR offers tremendous benefits in work production. Investment in it pays many tangible and intangible dividends.

It is admittedly difficult, however, to gather reliable data on improvement in work output. Savings due to reductions in accident frequencies usually have a surer basis because of better record keeping.

The writer is frankly skeptical of much data presented by some commercial interests. Too often the records are exaggerated or founded on inadequate research findings.

However, certain reliable evidence may be presented. Some time ago the National Industrial Conference Board of New York sent a questionnaire to 350 companies which had used color.

It was found, however, that many companies were unprepared to evaluate their programs primarily because of the difficulty involved in measuring the effects of a service as intangible as color. Yet despite the newness of the science of Functional Color the facts divulged were quite impressive.

64.7 per cent of the companies stated that color had improved lighting.

27.9 per cent reported production increases.

30.9 per cent noted an improvement in the quality of work.

19.1 per cent commented favorably on reduced eyestrain and fatigue.

14.7 per cent credited color for reduced absenteeism.

All-in-all, 75 per cent of the companies were entirely or well satisfied with their color programs; 5.9 per cent were not satisfied; 19.1 per cent had no opinion one way or the other.

Another and more carefully supervised study has been reported by the U. S. Public Buildings Administration and the U. S. Public Health Service in Washington, D. C. Over a period of two years an analysis was made of worker efficiency among employees using business machines. The test conditions included (a) the original room, (b) with the addition of lighting fixtures only, (c) with the further addition of color. The original area, in brown and buff, and with olive drab equipment was repainted in light tones of green and gray.

As to worker efficiency, one task had an improvement of 37.4 per cent. However, a conservative figure of 5.5 per cent has been set as the general improvement shown in the department.

In cash value, this 5.5 per cent production improvement was equivalent to a saving on gross payroll of $13,229 among some 95 employees. If this figure is a credible one — and the writer fully believes that it is — one may state that right illumination and right color are worth about $139.25 annually per average employee in American industry today! An organization having 100 employees would thus realize a year's saving of $13,925. For 1000 employees the annual saving would be $139,250. These figures, of course, would apply only where the before and after conditions were comparable to those of the government study. Yet because countless factories and offices are found that are as bad or worse, the monetary value of color is substantial and should be looked upon as a sound business investment.

Fewer Accidents — Bigger Profits

In the field of accident statistics and costs, very authoritative records and case histories are available. Here industrial management knows what it spends — and what it can save when frequencies are lowered.

In America the total cost of accidents is equal to $50.00 for *every man* employed. For those actually injured, the cost to industry will average from $1000 to $1600 or more for every accident. Big sums are therefore involved in lost time, compensation, medical expense and hospitalization. Reduce the accident rate and not only will life and limb be saved, but sizable profits will be realized which are, in reality, profits earned and money saved.

Here are a few case histories. The New York Board of Transportation, employing 38,000 workers, achieved a drop of 42.3 per cent in accident frequency with the introduction of a comprehensive color code plus active safety supervision and training. This was equivalent to an annual saving of over $500,000.

The U. S. Navy in a period of three years was able to lower its accident frequency from 6.4 to 4.6 — a drop of 28 per cent. Involved in this excellent record is a coordinated safety color code, "one of the contributing factors serving to reduce the Navy's industrial accident frequency rate." In monetary terms, according to compensation insurance statistics, this reduction meant a saving in excess of $1,400,000 a year among the thousands of civilians and enlisted personnel engaged in Navy industrial operations.

A steel company reported a drop of 75 per cent; a chemical company a drop of 65 per cent; a U. S. Quarter master Depot a drop of 48 per cent. Frankly, while these savings may not be attributed solely and entirely to a safety color code, nonetheless the code in each instance was the chief feature of the accident reduction effort.

Illumination, too, is important. Two British studies in the printing industry showed that the accident frequency dropped 54 per cent in one instance and 11 per cent in another when footcandle levels of illumination were raised. In a large American manufacturing plant higher light levels were partially responsible for a 32 per cent accident reduction. Accidents on stairways and transfer points in New York subway stations were lowered over 50 per cent when more and better lighting was introduced.

The writer has been able to estimate, on a basis of research fact, that good illumination and color in industry have a cash value of $139.25 per worker per year *in increased productive efficiency and capacity*. What might be a comparable value for *decreased accidents?*

In the instance of the New York

* Industrial Color Consultant. This article is condensed from a portion of a talk delivered for the U. S. Department of State at the First World Congress on the Prevention of Occupational Accidents, Rome, Italy, April 2-6, 1955.

Board of Transportation, mentioned above, the value in reduced accident cost could be set at $13.16 per worker, per year. This is probably on the high side, for in this case the percentage drop in frequency was rather unusual — 42.3 per cent.

Accepting the more reasonable figure of the U. S. Navy (a decrease of 28 per cent) let it be assumed that a plant employing 1000 persons was able to decrease its accident rate 28 per cent from a frequency of 10.35 to 7.44 (the general average for all United States industries). Using accepted accident costs, as determined by the National Safety Council and casualty insurance companies, the annual saving for 1,000 workers would be $9167, or $9.17 per worker.

This is a fair and conservative value, and far under the figures reported by many large and responsible organizations. It is, for example, based on an exceptionally low before-and-after frequency record (from 10.35 to 7.44). If the same 28 per cent reduction were figured at higher frequency rates, the cash value would accordingly be much greater.

In the majority of industries today, both in America and throughout the world, accident frequencies are quite above the 7.44 national average of the United States. Therefore a lot is at stake, so to speak, and tremendous sums of money are to be saved — not to mention human lives, eyes, arms, legs, fingers. All too clearly, better illumination and color, a coordinated safety code, a proper application of brightness engineering to walls, equipment and machinery are sorely needed. When intelligently applied, industry stands to reap a substantial profit.

This figure, $148.42 ($139.25 plus $9.17), stands as a reliable estimate of the value, per worker, per year, for better illumination and color in industry. A manufacturer may use it to figure the savings possible within his company. So may labor organizations, municipal and national governments multiply $148.42 by the number of workers under their supervision. Not included in the $148.42 figure, of course, are the humanitarian benefits of physical security, of the preservation of human skill, of mental and emotional well being, of an improved standard and dignity for human labor.

Water-Cooled Engine Omits Fan, Pump and Radiator

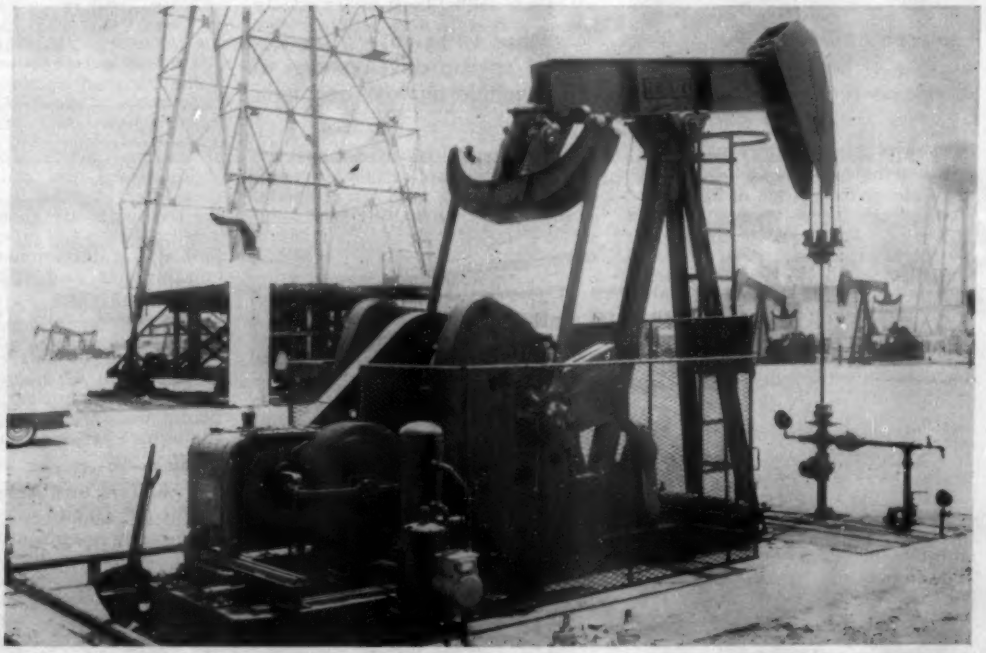
IF A NEW engine arrived from the factory without radiator, fan, water pump, fan belt, or radiator hoses, and it was supposed to be a self-contained unit, you could expect the customer to raise a justifiable noise about it. But not in this case. Minneapolis-Moline has built an engine that way on purpose.

Built for pumping duty where it might be serviced only once each year, the new engine provides a 20-gallon oil reservoir and a 12-gallon coolant capacity. Oil is circulated by a rotor-type, crankshaft-mounted pump and is filtered inside the crankcase. Coolant is circulated through the crankcase base pan casting to eliminate the external oil cooler.

Most striking, of course, is the lack of traditional cooling system components. A radial cooling unit is mounted in the flywheel, which eliminates the need for a fan and pump plus their drives. In the event of low oil pressure or high coolant temperature, the magneto is automatically grounded to stop the engine.

At this time, the engine is built only in the 20-bhp size and is set up for operation only on natural gas. Smaller units, in the future, may also burn l-p gas.

Tests conducted during '54 and '55 indicate continuous operation for a year without servicing.



Two-cylinder, 20-hp pumping engine looks undressed without the traditional accessories. All cooling requirements are met by one unit built into its flywheel

General view of a previous Power Show. It shows the wide diversity of equipment exhibited by manufacturers of prime movers and auxiliaries, steam-generating equipment and accessories, piping and electrical systems, of which many new designs to meet fast-developing requirements will be displayed at Chicago Power Show of 1955 in the Coliseum

Chicago Power Show Will Feature New Designs

Featured at Chicago Power Show, November 14 to 18, will be new designs of power equipment to meet the coming developments of atomic power and high-pressure and high-temperature steam plants

Hours of Exposition:
Mon. Nov. 14— 2–10 P.M.
Tues. Nov. 15—11 A.M.–10 P.M.
Wed. Nov. 16—11 A.M.– 6 P.M.
Thurs. Nov. 17—11 A.M.–10 P.M.
Fri. Nov. 18—11 A.M.– 6 P.M.
Location of Coliseum:
South Wabash Ave. at 15th St.

NEWLY-DESIGNED equipment will be extensively featured at the Chicago Exposition of Power and Mechanical Engineering, to be held in the Chicago Coliseum, November 14 to 18. Engineering advances of the year will be topped by exhibits of noteworthy alloys, especially fabricated to meet supercritical demands. Others will reveal the penetration already made in mechanical equipment manufactures by atomic power applications.

Atomics—New Feature

The exposition will be held under the auspices of the American Society of Mechanical Engineers in conjunction with its Diamond Jubilee Annual Meeting, climaxing the year-long celebration of the Society's 75th year. The Coliseum, near hotels where the ASME meetings will be held, affords excellent display facilities, and is easily accessible for frequent visits by members and guests.

The Atomic Power Section will be a new feature at the exposition. It has been organized to demonstrate phases of the application of atomic energy to power that are of special interest to mechanical engineers, supporting the program of technical papers to be offered at the ASME meeting. The atomic energy section of the meeting program will be contributed by the Nuclear Engineering Division, recently organized under the chairmanship of A. C. Pasini, of The Detroit Edison Co.

Nuclear engineering has already created many new problems, from the shielding of reactor plants and radioactive materials in transit and in use, to many novel functions, such as reactor operation, disposal of radioactive wastes, and even the machining of "hot" materials — all of which must be conducted by remote observation and control, requiring many new mechanical devices.

One exhibitor in the atomic power section will present a resume indicating the hard core of the fast-spreading atomic engineering industry. This will show that of about one hundred of the most active, non-speculative organizations now operating, more than 40 are engaged in mining, while the remainder are about equally divided between the processing of materials; the development of reactor components and supplementary equipment; and applications of atomic power under Atomic Energy Commission projects — submarine, surface and aircraft — or else are associated in development work on the four great nuclear power utility plants that are already in progress somewhere between blueprinting and construction.

Boilers and Accessories

Among exhibitors of mechanical engineering equipment to which space in the Coliseum has recently been allotted are the manufacturer of an extensive line of packaged boilers, and another exhibitor whose specialty is a quick-firing boiler of a type favored in plants where there is an intermittent demand for high-pressure steam. A third exhibitor has

an enviable record in equipping plants for the control of fly ash. Space was also allotted recently for the display of a revolutionary new drafting desk.

A manufacturer with a background of 80 years in the steam packing industry will be in the exposition with a line of mechanical packing and seals, expansion joints and molded rubber products. Adjustable pipe hangers and supports, constant supports and spring hangers will be exhibited by another well-known manufacturer. For insulation and corrosion protection of hot underground piping, another display will illustrate the properties of a unique granular material that hardens into a permanent coating when heated.

There will also be an exhibit of underground and overhead prefabricated insulated piping for steam and hot water, as well as piping systems for viscous liquids, heat exchangers and tank suction heaters. Newly-engineered system of cable and tubing raceways having wide adaptability for industrial plants will be on display.

New designs will appear in even as familiar a tool line as the boiler tube expander. An exhibitor of three specialties in this line has produced an expander with taper rolls of suitable length to roll tubes closely spaced in thin tube sheets, such as are used in packaged boilers. After five years of intensive development, another exhibitor has introduced a new line of traps available in semi-steel, cast steel, and forged carbon moly, having high maximum capacity, but designed to operate on very low condensate loads.

Power Distribution

Power distributing equipment will be well represented at the exposition. Clutches, couplings, hangers, pillow blocks, speed reducers, speed increasers and variable speed transmissions will be shown in considerable variety. So will motors and controllers. A number of unusual types of alternating current electric motors will be shown in action by the American subsidiary of an English manufacturer.

Among displays of motor maintenance equipment will be a line of commutator and armature testing and repair appliances, also several new types of metal working saws and a line of protective dust masks and eyeshields. A manufacturer with 40 years' experience in commutator and ring brushes for motors and generators will offer a new line of mechanical and electro-thermal carbons for bearings, seals and other special applications.

A manufacturer of materials handling equipment and rubber products will introduce a new electronic level indicating instrument. This consists of a small radio transmitter housed in a rugged steel probe, which is set at the predetermined levelling point. When material flows to that level, change of pressure on the probe distorts the signal to the control unit, which may then trigger an alarm or actuate a control system. At the same display will be a car shakeout, such as is widely used in the handling of ore, coal, gravel, sand, grain, chemicals and other bulk materials.

These are typical of the many new developments that will be shown by over 100 leading manufacturers during the 75th Anniversary Meeting of ASME.

I. E. Moultrop is chairman of the advisory committee of the exposition, and John H. Lawrence, vice chairman. Membership of the committee includes men of distinction in many engineering lines, as well as members of ASME. Representatives of the Society on the committee are the following from various organizations:

D. W. R. Morgan, president of the Society; A. C. Pasini, The Detroit Edison Co.; G. A. Hawkins, dean of engineering, Purdue University; Robert B. Lee, coördinator of exports, The Sperry Corp.; Alex D. Bailey; J. H. Davis, president, Stevens Institute of Technology; J. D. Cunningham, president, Republic Flow Meters Co.; Ronald B. Smith, vice president, The M. W. Kellogg Co.; Roland W. Flynn, division lubrication engineer, Gulf Oil Corp.; C. E. Davies, secretary, ASME.

The exposition is under the management of the International Exposition Co., with headquarters at 480 Lexington Avenue, New York 17, N. Y. E. K. Stevens is manager of the exposition.

The Leaning Panel

By E. H. COXE *

IN A RECENT installation of mercury arc rectifiers in an existing space of limited area, it was found that one rectifier would be "trapped" in a corner, between the companion rectifier and the control panel, so that it could not be removed, when necessary, for repairs or overhauling. Overhead clearances would not permit carrying the trapped rectifier over the other rectifier or control panel.

The photographs show the solution of the problem. The panel was hinged at the lower front edge; the cables were installed with some extra length dropping into a pull box under the floor, and with the aid of the overhead crane, the panel is laid over on its face, thereby allowing adequate clearance for moving the rectifier.

*Supervisor, Rectifier Substations, Ethyl Corporation.

Fig. 2. Panel was hinged at lower front end. Extra long cables run to pull box

Fig. 1. Mercury arc rectifier trapped behind panel so it could not be moved

Fig. 3. To move rectifier, panel is laid on its side and rectifier lifted over it

Power Engineering handbook

Preventing and Locating Accidental Grounds in Power Cables

By RALPH R. TAGGS

REGARDLESS of the type cable you bury underground, whether rubber-sheathed, synthetic-jacketed, armor tape, non-metallic armor, or lead, ordinary precautions in its installation will prolong its useful life and prevent service interruptions. These ordinary precautions can also reduce safety hazards to workmen who might be digging over the area.

Heed these suggestions, then, in burying cable (numbers are keyed to Fig. 1):

1. Dig trench deep enough (not less than 18 in.) so that cable will not be disturbed by plowing, surface digging or paving excavations.

2. It is preferable to lay a sand cushion, or at least have a sand base of the trench loosened and cleared of rocks and other rough projections. The cable is laid on this prepared bedding. When three single-conductor cables are laid in a trench it is desirable — for the best electrical and mechanical results — to keep them uniformly separated by 3 to 6 inches. The earth and sand can then be filled in around them without bringing them in contact with one another. If it is necessary to transpose cables, use transposition insulator separators.

3. A creosoted plank or concrete slab (or both) laid 6 to 8 inches above the cable gives it added protection and warns off workmen who might be digging over the cable.

4. After laying the cable, but before backfilling, cover it with soft earth or sand which is free of rocks, stones or rubbish, so that they will not eventually damage the cable when flooding or frost heaving disturbs the surrounding earth.

Precautions required for cable installation vary with the type soil and location (there is more digging in urban areas than in the country). Just remember when burying cable that you are *then* determining the cable's life and future hazards to workmen.

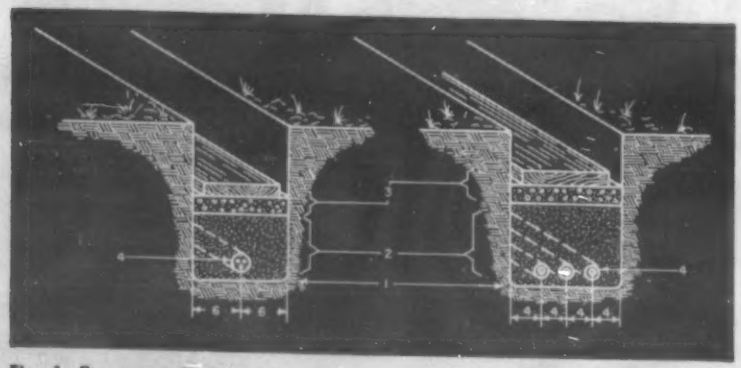


Fig. 1. Proper methods to bury multi- or single-strand conductors for long life

Spotting Faults in Buried Cables with Voltmeter and One or More "B" Batteries

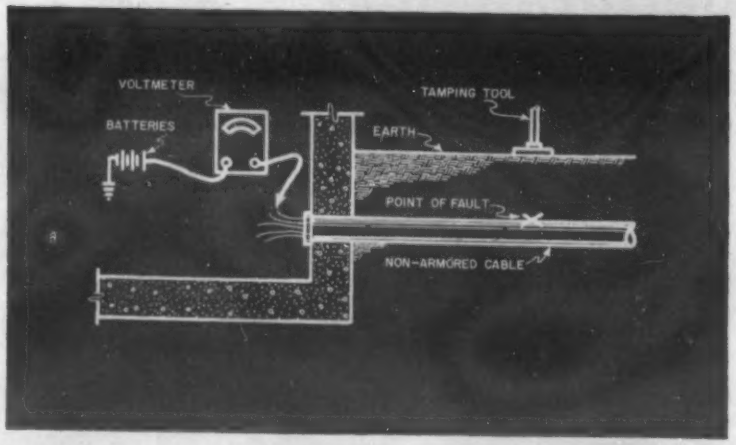


Fig. 2. Battery-voltmeter method of locating ground fault in underground cables

LOCATING ground faults in buried synthetic or rubber-jacketed non-armored cables has always been a difficult problem. However, with a voltmeter and one or two "B" batteries, we have been able to locate such cable ground faults within a few feet. This means that we need not excavate much real estate.

Most ground faults in such cables can be traced to moisture encroachment forming a conducting path from wire to ground, then progressive heating, drying, current-tracking and ultimate total breakdown of the insulation. The resistance of the fault is rarely constant over any long period, hence straightforward resistance methods (such as the Murray and Varley loops) are useless.

In finding such faults, isolate the wires at each end of the cable; then apply a d-c voltmeter and battery potential sufficient to effect a half-scale indication on the instrument. Connect the battery(ies) in series between one end of the faulty wire and the ground (earth). This makes a closed circuit (see Fig. 2) through the conductor to fault, ground return, voltmeter and battery.

Station one man at the voltmeter as an observer. Let another take a heavy

Large paper box company uses this Cochrane Reactor for Selected Calcium treatment of well water. 59'6" in diameter at bottom and 19'6" deep it provides 3,154,000 lbs. per hour treated water.

Cochrane

Solids-Contact Reactors

cut costs

IN PAPER MILLS

Coagulation and clarification of surface waters, cold lime softening of well or surface waters, reduction of alkalinity, silica, fluorides, etc., treatment of white water from paper to recover fibre and warm water are only a few of the many processes performed more efficiently—and at less cost—by a Cochrane Solids-Contact Reactor.

Because of the Reactor's special "catalytic" action, the newly-formed precipitates plate out and grow rapidly—provide more complete reactions and produce clear water in shorter time, saving in size of the tanks employed. Chemical savings are impressive, and water waste is kept to a minimum. De-sludging is completely automatic. For further information, write for Publication 5001-A.

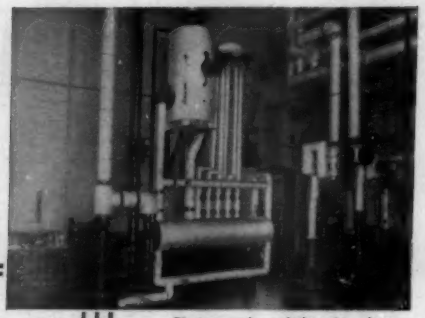
Cochrane
CORPORATION

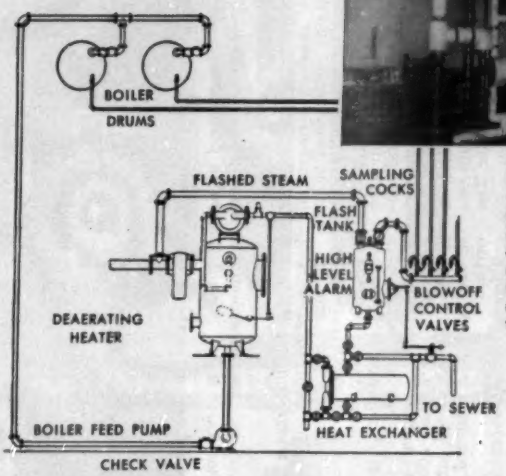
3123 N. 17TH STREET, PHILADELPHIA 32, PA.
NEW YORK • PHILADELPHIA • CHICAGO

Representatives in 30 principal cities in U.S.A.

Demineralizers • Hot Process Softeners • Hot Zeolite Softeners • Dealkalizers • Reactors • Deaerators Continuous Blowoff Systems • Condensate Return Systems • Specialties AD 7.12

For more data circle 586 on Post Card





Photograph and drawing showing installation of a Cochrane Class I Continuous Blowoff System of the type most frequently encountered. This sytem is recommended for use where heat recovered from the Cochrane Continuous Blowoff System does not exceed the rating of the feedwater heater.

Here are some typical savings with a Cochrane

CONTINUOUS BLOWOFF SYSTEM

- **A Utility: $15,400.00 annually**
- **A Sugar Refinery: 3,500.00 annually**
- **A Power Plant: 6,700.00 annually**
- **A Packing Company: 1,500.00 in first year**

(Names of companies on request)

Rising power plant operating costs make complete utilization of heat more important to your company than ever before. With a Cochrane system you can recover practically *all of the heat of the blowoff*. Both flashed steam and heat from hot waste water are returned to the feedwater system.

In addition, Continuous Blowoff provides more uniform boiler concentrations, smoother boiling conditions and cleaner steam.

Cochrane Corporation designs and manufactures complete lines of deaeration, precipitation, ion exchange and water conditioning equipment. Call Cochrane first for water treatment.

Write for Cochrane Publication No. 5700.

Cochrane
CORPORATION

3123 N. 17TH STREET, PHILADELPHIA 32, PA.
NEW YORK • PHILADELPHIA • CHICAGO

Representatives in 30 principal cities in U.S.; Toronto, Canada; Paris, France; La Spezia, Italy; Mexico City, Mexico; Havana, Cuba; Caracas, Venezuela; San Juan, Puerto Rico; Honolulu, Hawaii.

Pottstown Metal Products Division—Custom built carbon steel and alloy products

Demineralizers • Hot Process Softeners • Hot Zeolite Softeners • Dealkalizers • Reactors Deaerators • Continuous Blowoff Systems • Condensate Return Systems • Specialties

For more data circle 538 on Post Card

dirt-tamping tool and thump the earth at various points along the cable run. When he tamps in the vicinity of the fault, a definite change in deflection of the voltmeter will occur. Needle deflections can usually be spotted when the tamper comes within 10 ft of the fault, and they will become progressively stronger as it comes closer.

Keep in mind that changed resistance at the fault is caused by disturbance of the earth at that point. Other indicating devices can be used, but remember to keep the current low (from a few milliamperes to 500 ma). High currents will dry out the moisture at the fault and make it more difficult to locate as the fault resistance increases.

Spotting Ground Faults in Buried Non-Metallic Series Street Lighting Cable Under Earth or Concrete Slab

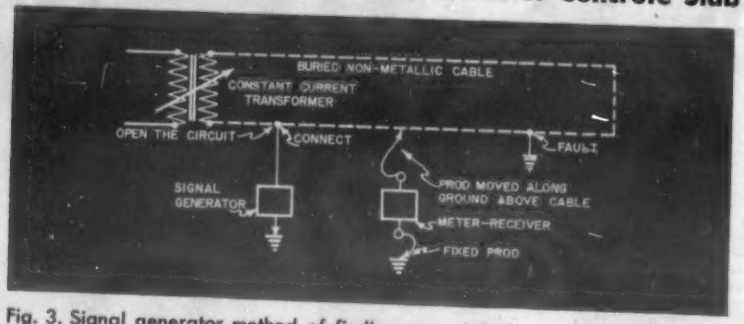


Fig. 3. Signal generator method of finding ground faults in non-metallic cables buried in the earth or under concrete slabbing—not for use under asphalts

THIS method of ground-fault tracing applies only to those line-to-ground faults in non-metallic series street lighting cables covered with earth or concrete slabbing — but *not* if it is under pavement. This method has been used for the past 10 years by the Indiana-Michigan Electric Co. with great success. It save times and expense of a lot of excavating. It is easy to use and, in most cases, locates grounds within one or two feet of the actual fault. The method requires this equipment:

1. Western Electric Type 20-C generator transmitting a broken 400-cycle signal which produces a tone easily identified among other noises. (There will be street, mechanical and electrical noises to distinguish.)

2. Receiver, a simple two-stage audio amplifier with headphone and meter attachment, used separately or together. Headphones should be the light-weight under-the-chin type since they are ideal for eliminating street noises. The meter is a d-c, 0-1 milliammeter with an oxide instrument rectifier.

To locate a line-to-ground fault, open the buried cable at some convenient point, find the grounded conductor, and connect it to one side of the signal generator (see Fig. 3). The other output terminal of the signal generator is grounded. The broken 400-cycle signal is transmitted along the cable conductor to the fault and returned through the earth.

The receiver is connected by flexible cables to two metal prods. One is stuck into the ground at least 10 feet from the cable, and the other is carried along the cable path and stuck into the ground every few feet. The interrupted 400-cycle tone in the earphones increases as the prod approaches the fault.

When the meter begins to indicate slightly, the earphones are discarded. Since the 400-cycle signal is broken, the meter reading will pulsate to distinguish it from stray ground currents. The meter reading will peak over the fault and diminish as it is passed. The fault will normally be found within one or two feet of the maximum meter reading.

If the cable is buried under a concrete slab, its moisture content will give results comparable to those obtained when the cable is buried directly in the earth. *This method will not be satisfactory for cables buried under asphalt pavement unless contact with the earth below is made possible.*

Spotting Low-Resistance Faults on 3-Phase Secondaries

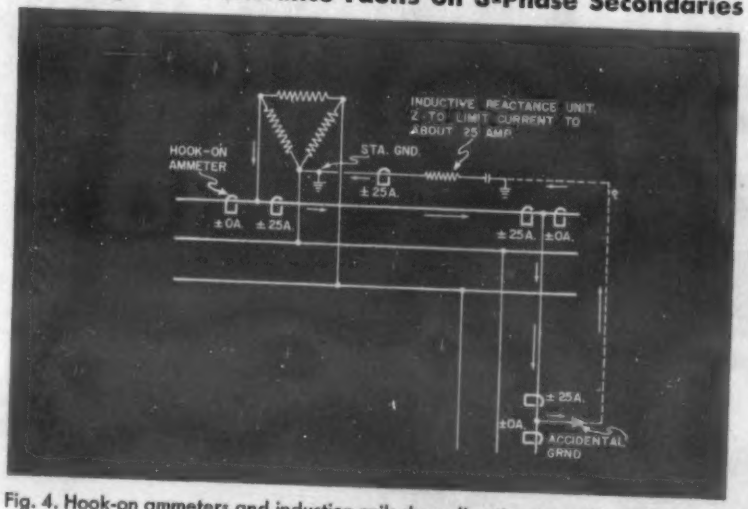


Fig. 4. Hook-on ammeters and induction coils show direction to accidental grounds

TO LOCATE low-resistance grounds on three-phase power secondaries, both star and delta networks, a large Western utility grounds the station transformer earth connection (the permanent ground) intermittently through an induction coil and checks the pulsating current in the troubled phase with a hook-on ammeter as shown in Fig. 4.

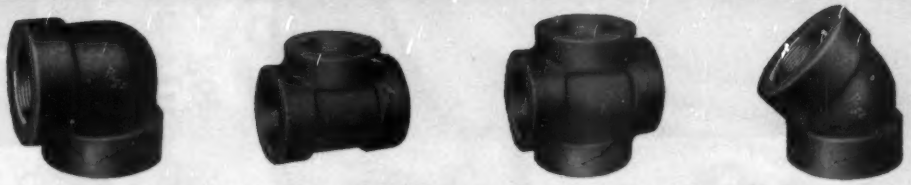
Generally this method is used where a driven ground rod(s) at the transformer(s) does not provide a positive, low-resistance ground. The induction coil is connected between the transformer bank ground (broken for the test) and a perfectly reliable ground point such as a water line. The hook-on ammeter indicates the *load* current plus the *intermittent* current. This current is generally about 25 amps, the induction coil being designed to pass this maximum amount of current.

The second test is on the line wire, where the intermittent current indicates the direction of the accidental ground from any junction point. This test is usually made at a corner pole or at cable terminators, potheads, etc. Connecting the induction coil to an ungrounded phase and moving the ground along so that current can be applied where the ammeter is being read gives a positive test.

Of several types of load tried, tapped resistances or induction units have been most satisfactory. Best results have been obtained with an iron-core induction unit with four separate coils, or windings. Its leads are brought out to terminals so that the entire unit may be connected in series or parallel, or series-parallel, for the standard utilization voltages (120, 240, 360 and 480) to pass the desired 25–50 amps.

STRENGTH

for Safety and Long-Time Service



For 2000, 3000 and 6000 pounds service — Sizes 1/8" to 6"

SCREW END TYPE

For schedules 40, 80 and 160 pipe — Sizes 1/8" to 4"

SOCKET WELD TYPE

Vogt Ells, Tees, Crosses, etc., are forged from carbon steel or various alloys to meet specific operating conditions. Catalog F-9 will aid you in their selection and proper application.

Shocks and stresses imposed by high pressures and high temperatures are taken in their stride because Vogt fittings are uniform in structure, fine grained, and free from porosity . . . the superior product of laboratory controlled materials and giant forging hammers and upsetters. These properties also give higher resistance to erosive and corrosive conditions, thereby adding to service life expectancy in steam plants, petroleum refineries, chemical plants and related industries.

Vogt

HENRY VOGT MACHINE CO., INC
Louisville 10, Kentucky
BRANCH OFFICES: NEW YORK • PHILADELPHIA • CLEVELAND • CHICAGO • DALLAS

DROP FORGED STEEL FITTINGS

For more data circle 539 on Post Card

cut along this line

Power Engineering handbook

Build Up Waterwall Insulation With Mineral Wool Block, Asbestos Rope

(Photos courtesy the Baldwin-Hill Co., Trenton, N.J.)

THERMAL insulation of waterwalls can be applied in many ways, but here is how Detroit Edison did it at the Conners Creek and St. Clair power plants. They used mineral wool block over refractory cement, which in turn was trowelled on over expanded metal lath.

Asbestos rope formed a seal between the block and the steel casing to prevent bypass of flue gas which might leak through the insulation after normal deterioration. These photos show how the job was done, step by step.

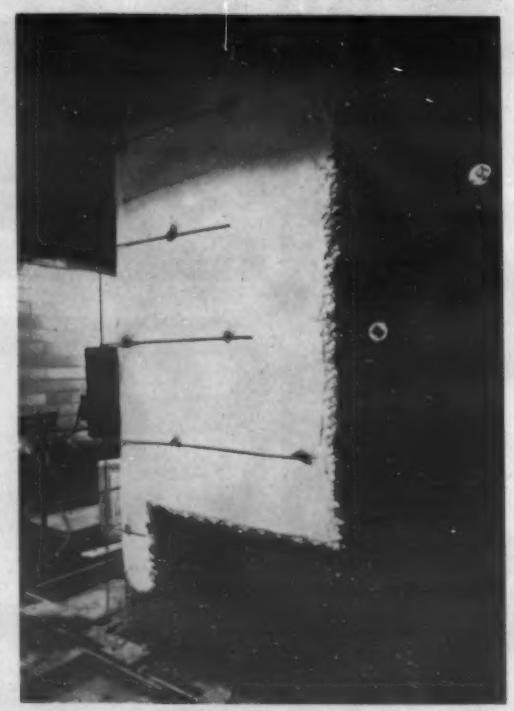


Fig. 1. Weld studs to boiler tubes at 24-in. intervals horizontally, and (assuming an 18-in. mineral wool block) at 18-in. intervals vertically, staggered as shown. Expanded metal lath is fastened to the studs with washers and speed clips, then a 1½-in. layer of refractory cement is trowelled over it. Horizontal ¼-in. pencil rods are welded to the studs over the refractory as shown

fold along this line—outside edges toward you

Fig. 2. Mineral wool blocks are secured to the face of the refractory by tie wires, which are first tied to the pencil rods. Detroit Edison specifies at least three pairs of tie wires per block, tied over the face

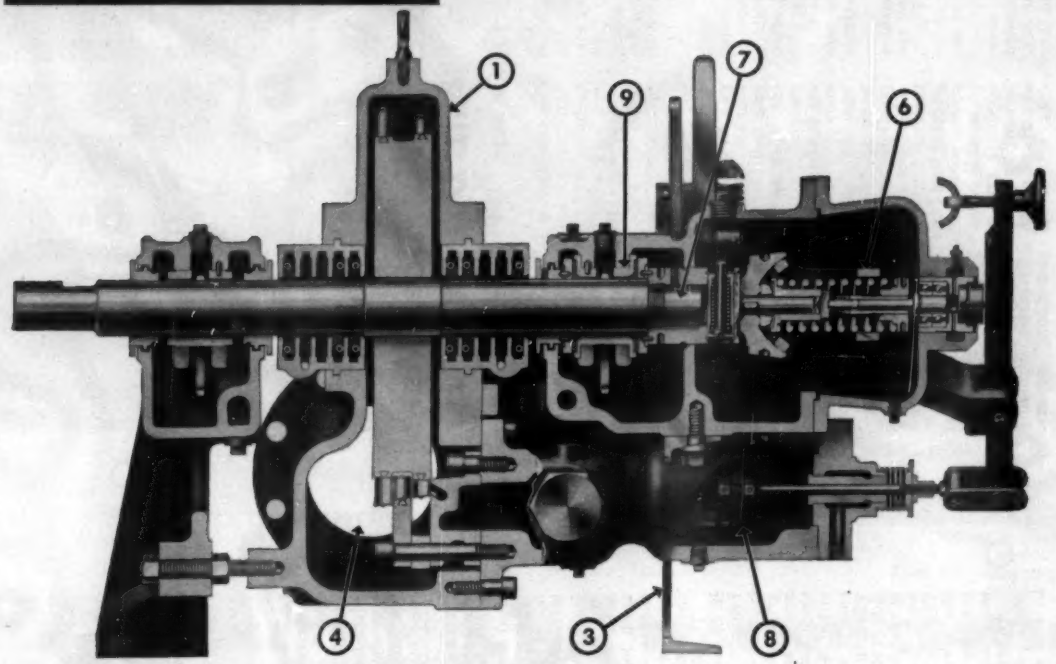
Fig. 3 (Below) All joints and voids in the block insulation are filled with mineral wool insulating cement. Asbestos rope is tied to block face in patterns to break up natural circulation or flue gas bypass after the ½-in. steel boiler casing is added over the insulation. Asbestos rope seals are set horizontally and/or vertically

NEW DE LAVAL

HCB

SINGLE STAGE TURBINE

can be ordered from stock



1 Case and Cover Split Horizontally on centerline for ease of maintenance.

2 True Centerline Casing Support assures distortion-free radial expansion. *Not shown.*

3 Flexible Support at governor end provides for axial expansion.

4 Exhaust Opening either right or left side for installation flexibility.

5 Steam Strainer, protecting trip and governor valves, is *removable* for cleaning without breaking steam connections. *Not shown.*

6 Constant Speed Governor features governor weights pivoted around frictionless surfaces.

7 Complete Governor Assembly is now *replaceable as a unit.*

8 Balanced Single Seated Main Governor Valve has proportional flow characteristics for sensitive, positive control.

9 Shaft Locating Bearing of adjustable double collar type.

Horsepower: 100 MAX
Steam Pressure: 300 PSIG MAX
Steam Temperature: 550F MAX
Exhaust Pressure: 25 PSIG MAX
Speed: 4,000 RPM MAX
Steam Inlet: 2"–250# ASA FLG.
Exhaust: 6"–150# ASA FLG.
Weight: 1,200 LB

Here's the new De Laval HCB Single Stage Turbine which is now "on the shelf" . . . ready for immediate shipment. This mechanical drive turbine is simple, rugged, designed for long economical life and low maintenance. For example, note the true centerline casing support, the replaceable governor, the removable steam strainer. Investigate all the advantages of this versatile driver. It is ready to handle—*at low cost*—a variety of applications in your plant.

Send for new Bulletin 4206
which gives vital facts and figures

DE LAVAL *Mechanical Drive Turbines*

DE LAVAL STEAM TURBINE COMPANY

816 Nottingham Way, Trenton 2, New Jersey

DL30B

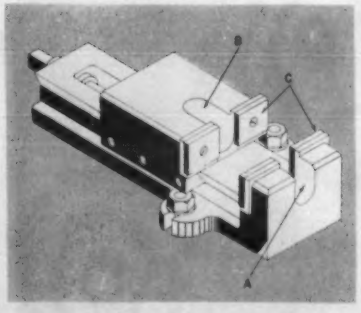


Fig. 1. Mill slots in fixed and movable jaws (A and B). Detachable jaws (C) are cut separately

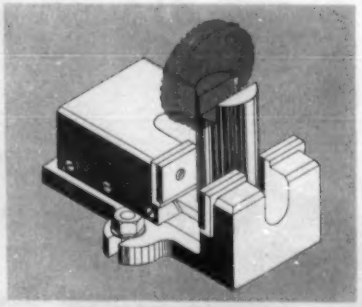


Fig. 2. Cylindrical pieces are gripped by the four corners of the detachable vise jaws (C, Figure 1)

Reworked Machine Vise Does More And Does It Better

By F. E. RILEY

HEAVY-DUTY machine vises are almost permanent fixtures on the tables of shaping machines, milling machines and drills. A vise of this type finds its greatest use in general machine shop work, and its versatility is increased considerably if it is mounted on a swivelling base which is graduated on the edge in increments of one degree.

Unfortunately, the standard machine vise is not very efficient when called upon to grip cylindrical or contoured work pieces. Crude set-ups involving packing blocks and the like will often enable the machine operator to grip cylindrical work in the vise, but it is usually necessary to remove the vise from the machine table and to substitute some other form of work holder.

Work holding versatility of a machine vise can be extended by modifying the jaws in the manner illustrated in Fig. 1. A slot is milled through the center of the fixed jaw at A; the slot is rounded at the bottom so that the weakening effects of square corners are avoided. A disk-shaped milling cutter with a rounded edge is used for machining out the slot. A corresponding slot is also milled into the moving jaw B, extending for about half the jaw length. The hardened detachable jaws C should be removed and cut with a rubber bonded cutting-off disk so that there is a gap between them when the two halves are once more mounted in place on the vise jaws.

One use for the modified vise jaws is the gripping of cylindrical work pieces vertically, as illustrated in Fig. 2. The gap on each side of the work results in four sharp edges which will obtain a firm grip and there will be no tendency for the work to fall over sideways. This method of gripping can be used for milling square and hexagonal shapes on the ends of cylindrical pieces. The graduated base of the vise, where fitted, allows the work to be indexed to new angular positions for successive milling cuts.

The four gripping edges presented by the slots in the jaws can also be used for gripping small and irregular-shaped work pieces, particularly those cut from metal plate. It is usually possible to obtain an adequate grip on such pieces for performing light machining operations such as surfacing with a fly-cutter or milling slots with small end-milling cutters.

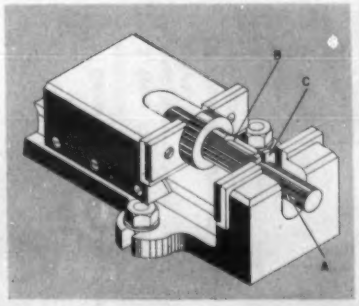


Fig. 3. Shaft (A) is gripped axially between the slotted jaws, using a split washer (C) if needed

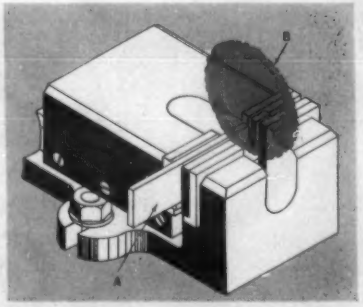


Fig. 4. Slotted jaws permit steadier support of a work-piece (A) as cutter (B) works within the jaw

Plate-form work pieces gripped in this way should be supported from below in the usual manner by means of suitable packing strips.

Sharp edges which grip the work may produce undesirable burrs on finished work pieces, but this can be avoided by substituting soft pads for those of hardened steel.

One way of gripping a stepped cylindrical shaft A in the modified vise jaws is illustrated in Fig. 3. The standard method of holding this for milling the keyway B would be to mount a dividing head and chuck or some other form of work holder on the machine table. If the technique illustrated in Fig. 3 is adopted, there is no necessity to remove the machine vise from the table.

The shouldered shaft is gripped axially in the vise jaws. One slot in the jaws is bridged by the thick washer C which is slipped over the shaft. It is possible to grip a shouldered piece of work at right angles to that illustrated (Fig. 3) if the shaft has portions of equal diameter on either side of the shoulder. The shoulder can fit into the slots in the jaws which will grip on the circular portions on each side of it. The advantage of slotted jaws is that a firmer hold is obtained on the work than would be possible otherwise. The work is sunk well below the tops of the jaws and is held by their middle portions; there are no parts of the work projecting out of the vise jaws.

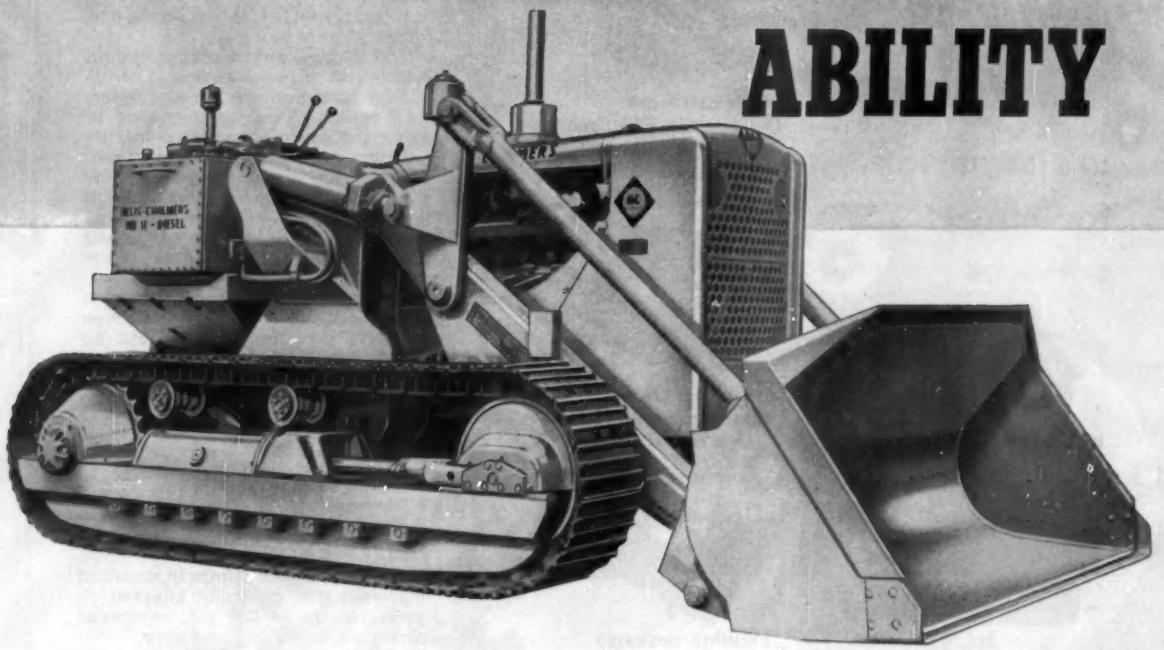
An indication of the superior support offered by split vise jaws is illustrated in Fig. 4. Here, the work A is a thin piece of steel strip requiring an accurate slot to be milled in it close to one end. With normal vise jaws, the work would have to project from one end of them to be accessible to the milling cutter B. The rate of milling must be slowed down in such circumstances to avoid bending the narrow tongue of metal at the bottom of the slot.

With split jaws, the cutter can be traversed through the split and it will be noted that the work is gripped and supported firmly on each side of the cutter. This double grip is particularly effective in overcoming many troubles associated with the use of narrow slitting saws.

These are but a few of the unusual work holding methods which can be adopted by modifying machine vise jaws as described. Splitting the jaws does not affect their usefulness for holding ordinary full-length work, and use of the vise for normal duties is not affected.

IF YOU have a work-saving idea, or a way of doing an old job in a new and better way, send it to us for review. If it is as good as you think it is, we will buy it for POWER ENGINEERING Handbook. Let your ideas earn twice: When you use them, and when you tell them

NEW COAL-HANDLING ABILITY



2¼-yd Standard Bucket
3¾-yd Light-Materials Bucket
105 net engine hp
32,000 lb
11-ft, 7-in. dump height

with the ALLIS-CHALMERS HD-11G TRACTOR SHOVEL

NEW POWER is provided by the modern, 105-hp Allis-Chalmers diesel. Tornado turbulence and "follow-through" combustion mean cleaner burning and more power from fuel, as well as smoother engine performance and extra long engine life. Added power pays off in extra crowding and loading ability, fast work cycles.

NEW CAPACITY — Big 2¼-yd standard bucket is streamlined to roll in large loads more easily. Improved design cuts spillage, clean dumping saves time and effort shaking out loads. Optional 2¼-yd tip-back bucket rolls back 25 degrees at ground level, handles bigger loads of loose material.

NEW STABILITY—Extra-long track — with almost 9 ft of track on the ground — plus 8 truck wheels on each side and 32,000 lb of weight, give the HD-11G unusual stability, plenty of traction.

NEW-TYPE HYDRAULIC SYSTEM is simpler, safer, easier to maintain. Tank has fewer external fittings. Magnetic filters and suction-line screens protect entire system. Hydraulic pump offers fast action, long life.

NEW OPERATOR CONVENIENCE — The HD-11G features easily controlled, accurate bucket action; reduced lever pull with new-type clutch; full vision; roomy platform; foam rubber seat; 60-gal fuel tank.

NEW DEPENDABILITY AND SERVICING EASE result from such features as heavy-duty truck wheels and idlers; new, long-life track; new-type, long-lasting, ceramic master clutch lining; unit construction's quick disassembly and assembly of major parts; 1,000-hour lubrication intervals for roller bearing truck wheels, support rollers and idlers.

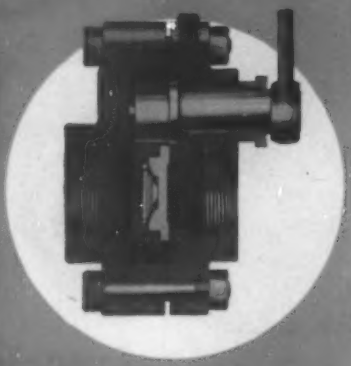
CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

Stop in soon and see the production-boosting HD-11G at your Allis-Chalmers dealer's.

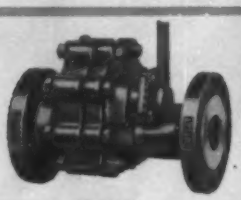
ALLIS-CHALMERS A-C

Everlasting Valves

are superior for many services



BOILER BLOW-OFF
Quick acting, also handwheel operated "Y" and angle types. For pressures up to 600 psi.



GENERAL SERVICE
Where drop-tight seal and full flow is essential.

CYLINDER OPERATED
Can be remotely controlled, electrically or manually.

When you want

- quick action
- drop-tight seal
- minimum pressure drop
- straight-through full flow
- self-grinding rotating disc
- valves that cannot wedge or jam

then you want an Everlasting Valve

No other valve has all the Everlasting features . . . proven by half a century of service to assure dependable, leak-tight service.

LET US HELP YOU WITH YOUR VALVE PROBLEMS

STEAM JACKETED
Assures free flow of viscous materials.

WEIGHT-OPERATED
For automatic drains or emergency shut off.

EVERLASTING Valves

EVERLASTING VALVE COMPANY
47 FISK STREET, JERSEY CITY 5, N. J.

EV308

For more data circle 542 on Post Card

Reciprocating Steam Pump

continued from page 61

packing, piston rod, throat lining, and pump cylinder lining.

The hydraulic-type plunger pump field is also of importance and seems to have been neglected to a considerable extent. This type pump, in either the single or duplex construction, has been and still can be used, in very high discharge pressures for press work or when handling liquid of low specific gravity. These pumps are naturally of close clearance type and lend themselves to services where other pumps are not suitable.

In order for a manufacturer to select and quote on a steam-driven reciprocating pump, he should be supplied with the following data:

1. Type of service
2. Liquid to be handled
3. Viscosity
4. Temperature
5. Specific gravity
6. Capacity
7. Head-discharge pressure in pounds
8. Suction conditi ns
9. Steam pressure available at throttle

If pump is for boiler feed, items 2, 3 and 5 may be omitted.

Horizontal duplex pumps in standard materials are generally adapted to pressures up to 250 psi; in special materials, to 400 psi and over.

CTI Research

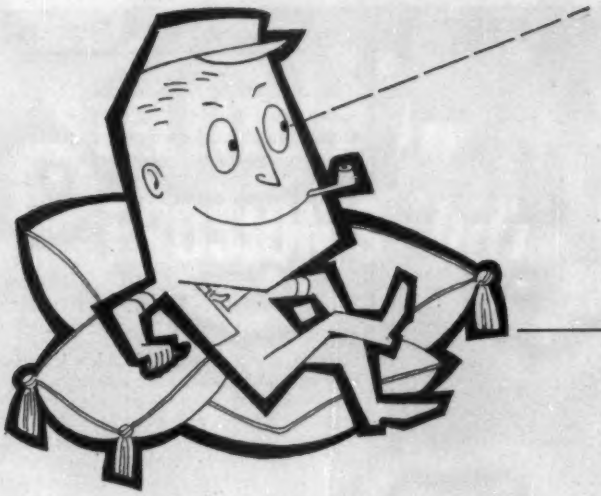
continued from page 73

Redwood Association, special cooling tower grades of lumber were developed to permit more accurate selection of lumber for structural application in industrial towers.

CTI Grades One, Two and Three are described in bulletin STD-101 as modifications of the yard grades of Clear All Heart and Select Heart with specific limitations for ring count, slope of grain, knots and other minor defects. No sapwood is permitted under the CTI Grade specifications.

With specific characteristics of the lumber qualified, it was possible for the CTI group to develop allowable design stress values for each of the CTI Grades. These values are shown in bulletin STD-102 and are applicable to air dried or green lumber and to seasoned lumber used in wet locations. In addition, the publication gives nominal weights of redwood and specifies nominal and dressed dimensions for use in the design and construction of industrial cooling towers.

All elements of the CTI specifications are compatible with the present drafts of technical society codes covering such equipment. During the development of the CTI standards, close liaison was maintained with the technical societies and coöperating trade associations.



Has that man gotten lazy? All he does is sit and watch the gauges.

The more he sits on his chair, the better I like it. It means the steam pressure is where it should be and everything is fine and dandy.

He used to be jumping around like a monkey on a hot stove.

That was before we got wise and changed our coal.

What kind of coal are we using now?

It's a high quality, low ash coal produced on the Chesapeake and Ohio. The C&O coal man recommended the exact grade best suited to our type of furnace. It burns hot and clean, with practically no smoke or clinkers and very few ashes. I've learned there's a lot more to buying coal than merely the price per million BTU's. It takes a competent combustion engineer to weigh all the factors and pick the coal that will give the most economical operation under a given set of conditions. Those C&O people really know their coals and I'm listening to their advice from now on.

P.S.

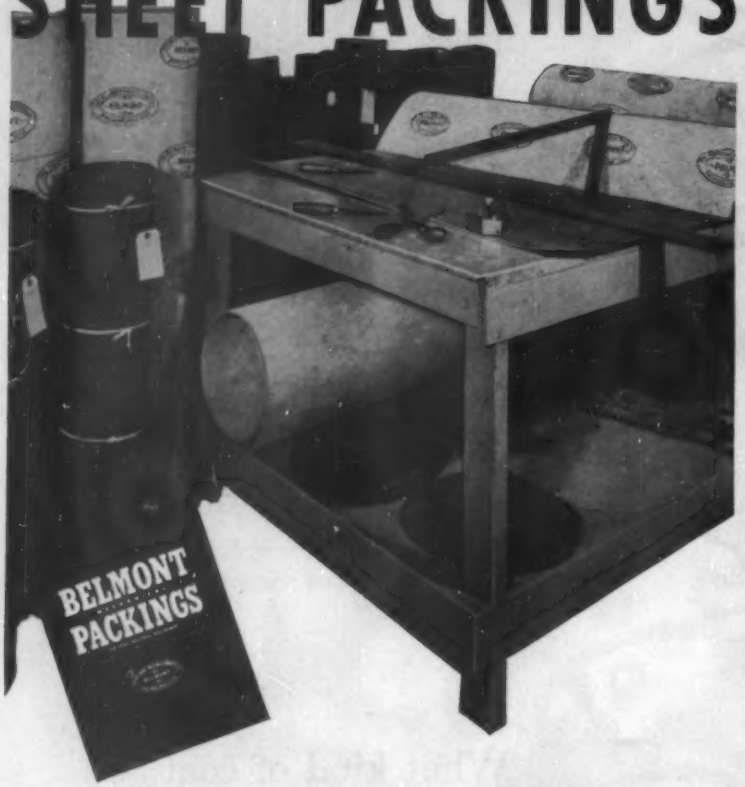
There's a lot more to buying coal than the cost per ton. For facts and figures to solve your particular fuel requirements, write to: R. C. Riedinger, General Coal Traffic Manager, Chesapeake & Ohio Railway Company, Terminal Tower, Cleveland 1, Ohio.

Chesapeake and Ohio Railway

WORLD'S LARGEST CARRIER OF BITUMINOUS COAL

For more data circle 543 on Post Card

BELMONT SHEET PACKINGS



ASK YOUR DISTRIBUTOR

You know the high cost of packing *failure* . . . but do you know the easiest, simplest and most economical way to *prevent* failures? The answer is to put your problem squarely in the hands of an expert . . . your BELMONT distributor. Working in close cooperation with Belmont's service engineers and technicians he is in an ideal position to help you select and apply the proper sheet packings for your services . . . speedily, economically, and all from a single reliable source.

Belmont sheet packings and gasket cutters are sold nationally through this experienced distributor organization. Use them and enjoy a new freedom from packing worry. When it SEALS right – stays TIGHT . . . you know it's Belmont made.

4-B-7

CLIP and Send Coupon

BELMONT PACKINGS

Butler & Sepviva Streets Philadelphia 37, Pa.

☐ Crisscross Braid Folder
☐ #54 Condensed Catalog
☐ #40 Catalog

Without obligation – send us information as checked:

Name ____ Title ____
Company ____
Address ____
City ____ State ____

☐ SEND NAME and ADDRESS of NEAREST BELMONT DISTRIBUTOR

For more data circle 544 on Post Card

Letters

continued from page 4

inlet vane controls, such as commonly found on axial-flow forced draft blowers, permit precise air regulation down to approximately 10 per cent of maximum capacity. — *George G. Nash, L. J. Wing Mfg. Co.*

Tobin's Reply

To the Editor:

IN ANSWER TO Mr. Nash's letter, our company will, and I believe the other major companies will also, make a guarantee on not over 10 per cent leakage through a closed damper on our fans. Generally, inlet vanes are not quite as tight because of their greater area and more length of crack as compared with outlet dampers, but should compare reasonably well with inlet box louvres or dampers.

Usually, axial flow fans do not damper or vane control as economically as centrifugal fans as explained in my earlier article which appeared in the May, 1954 issue under "How Much Power Does a Fan Need," Fig. 1. If this type of fan is used it is best to use a multiple installation as outlined by Mr. Nash in his letter with which I am in full accord with regard to the particular type of blower he is referring to. — *J. F. Tobin, American Blower Corp.*

Diesel Power Costs a Bit Misleading

To the Editor:

WE READ with intense interest the article in your May, 1955 issue entitled What Some Modern Diesels Cost.

That part describing the Bluffton, Indiana, plant shows for the year 1953, when the diesels were used exclusively, a fuel cost per kwh of 8.2 mills with the statement that this 8.2 mills showed a fuel saving of 18 per cent over the year 1952 when some power was generated by steam equipment.

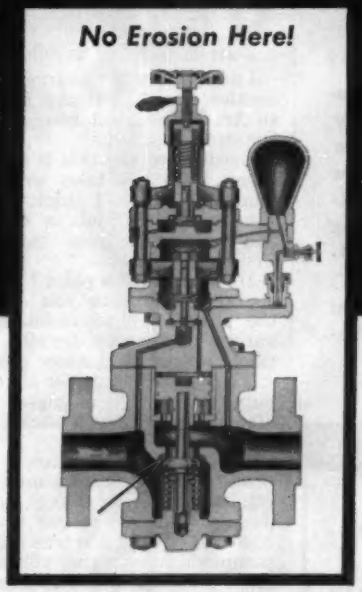
In this general territory any electric generating plant which has the exorbitant fuel costs of 8.2 mills per kwh should be a subject of pity rather than censure. The very few plants which have these very high costs usually strive for concealment rather than publicity.

The report to the Public Service Commission of the State of Indiana from this utility for the year 1953 shows 12.7 kwh per gallon of fuel oil. The oil cost per gallon is given as 11.2 cents, which would give a fuel cost per kwh of 8.8 mills.

Ft. Wayne lies in an adjoining county, and their city light plant is 100 per cent steam and is coal fired. The report of the city utility of Ft.

STELLITE'S *IN* EROSION'S *OUT*

No Erosion Here!



Arrow shows location of integral stellited seating surface in Leslie Pump Pressure Regulator.

Stellite as a *standard* seating surface for regulators and control valves in steam service is a Leslie exclusive. Combined with a hardened stainless steel main valve, stellite provides the most erosion resistant combination known, and is available in integral and renewable seating arrangements.

This unbeatable combination, pioneered in the field by Leslie, is the product of many years' experience and knowledge of proper stelliting and heat treating techniques. And with Leslie, it's *standard* in a wide range of regulators and control valves designed to meet any temperature or pressure requirements.

When erosion and wear are factors to consider, it will pay you to call your Leslie engineer to demonstrate how, with Leslie equipment, "Stellite's In — Erosion's Out".

TRADE LESLIE MARK

Write for Bulletin 552
"When To Use A Controller And When To Use A Regulator".

REGULATORS AND CONTROLLERS

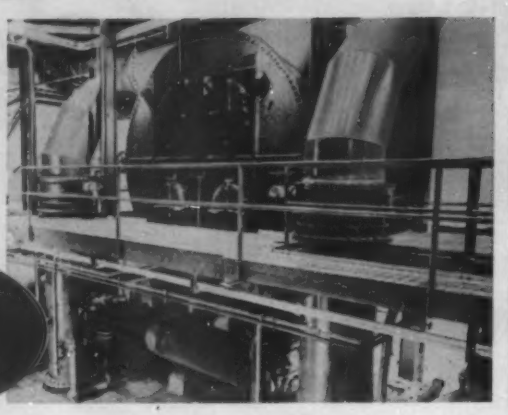
LESLIE CO., 301 GRANT AVENUE, LYNDHURST, NEW JERSEY

3872

CONTROLLED QUALITY MEANS QUALITY CONTROLS

For more data circle 545 on Post Card

CONSECO CONDENSERS
are better



A 33,000 sq. ft. divided flow Conseco Condenser installed in a large power plant. Unit exceeded performance guarantees. Hotwell is full deaerating type, eliminating deaerating heater from feed water cycle.

why?

.....because TROUBLE *has been Engineered* OUT

No one knows the design weakness of tubular equipment like the men who service it. Conseco Condensers are designed by engineers who work in close cooperation with our maintenance division which rebuilds, repairs, and modernizes condensers made by practically every manufacturer. Through this experience—through our intimate knowledge of where troubles develop—we forestall trouble in Conseco designed equipment. And because troubles have been "engineered out", Conseco Condensers and Heat Exchangers offer you maximum operating efficiency and low maintenance cost. Send for bulletins, stating your requirements.

CONDENSER SERVICE & ENGINEERING CO., INC. CONSECO

Designers and Builders of Equipment for Power, Refining, Chemical and Marine Industries

158 Observer Highway
HOBOKEN, N. J.

CONSECO MAINTENANCE DIVISION

Conseco maintenance division has been repairing, rebuilding, modernizing, and maintaining equipment used in the power, chemical, refining, and marine industries for over a quarter century. Our highly mechanized field crews are supervised by qualified engineers and backed by specialized manufacturing facilities and ample replacement parts. Thus you are assured of fast, efficient results at lowest cost. Conseco service is as near as your phone.

Phone
HOboken 3-4425
BArclay 7-0600

For Service
ANY HOUR
Day or Night
ANY DAY
Including Holidays
ANYWHERE
On the Continent

For more data circle 546 on Post Card

Letters

continued from page 106

Wayne to this same Public Service Commission shows for the year 1953 a fuel cost per kwh of 4.9 mills and for the year 1954 of 4.7 mills.

It would seem to me that this item of 18 per cent saving through the use of diesel power as compared to steam generated power is a bit misleading or else the citizens of Bluffton have been asked to pay for a lot of wasted moth-balls. — *Max A. Tuttle, Indianapolis, Ind.*

Reader, Author Exchange Views on Fuel Oil Handling

Editor's Note: — Almont Koepf's article in the April issue of POWER ENGINEERING, Handling Heavy Fuel Oil Is an Art, has aroused a good deal of comment. This month we are privileged to print an exchange of correspondence between the author and Albert Zalis, manager of Quimby Pump Division, Warren Steam Pump Company, Inc.

Zalis wrote Koepf as follows:

I HAVE RECENTLY READ your article entitled Handling Heavy Fuel Oil Is an Art in the April issue of POWER ENGINEERING.

Needless to say this is a topic on which little has been written and much should be. I think you have done a splendid job in correlating and presenting your information. Congratulations.

However, at this point I would like to take issue with you concerning the pumping characteristics of the various pumps you describe, specifically the gear and screw pumps.

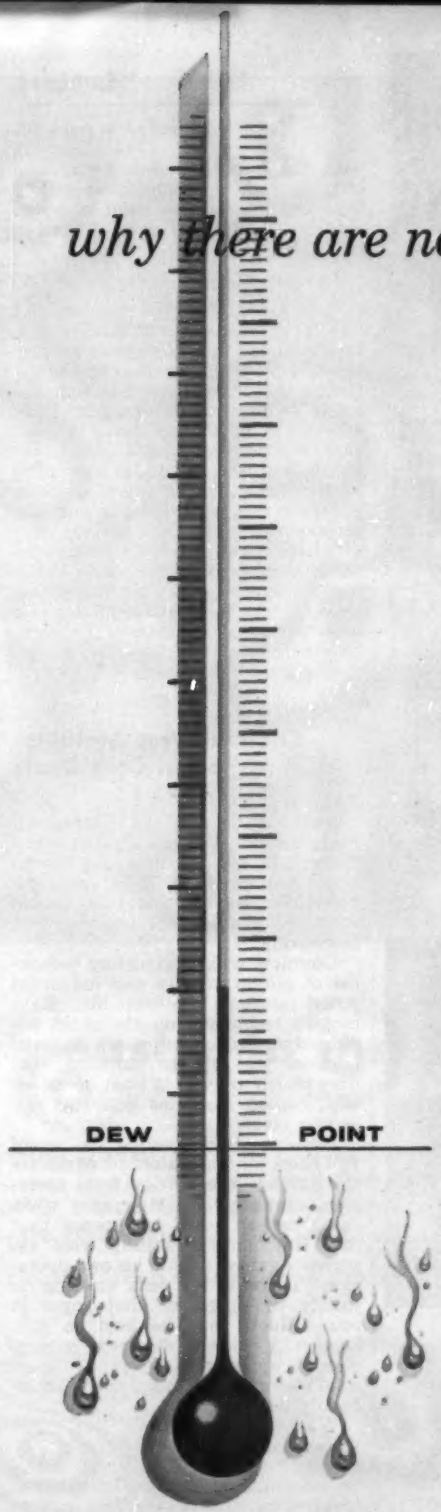
Your article indicates that a gear pump is capable of higher suction lifts and discharge pressures than a screw pump.

We can furnish a screw pump for pressures up to approximately 1200 psi, depending, of course, upon capacity. Capacity ranges from 1 to 3000 gpm. While it is true that a gear pump will have higher efficiencies at lower pressures, from approximately 100 psi up the screw pump will have an edge on efficiency also.

As far as suction lift is concerned, a curve plotted for suction lift (in. Hg) versus percentage loss of capacity would indicate much more unfavorable characteristics with a gear pump than a screw pump. Our screw pumps can develop suction lifts up to 25 in. Hg, and with modifications to the stuffing boxes, even higher.

It is felt that the above comments generally apply to the various pumps of similar design. Exceptions, of course, are the low capacity high pressure gear pumps for hydraulic service.

The above comments are not made



why there are no cold spots and less corrosion in the Ljungstrom® Air Preheater

In the Ljungstrom, the heat-transfer surface rotates alternately through the gas and the air streams . . . keeping heating elements consistently hotter than other types in equivalent service. That's why there are no cold spots . . . and less corrosion in the Ljungstrom.

Even though corrosive action is slow, some does take place at the cold end of the Ljungstrom. This presents no problem, since the cold end is sectionalized to permit easy reversal and almost double life. Reversing or replacing the cold end does not disturb the rest of the elements and takes just a few hours.

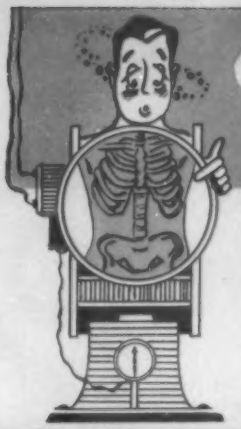
Get all the details on the Ljungstrom Air Preheater. Send for the new, free, 38-page reference manual, "Ljungstrom Air Preheaters."

Advantages of the Ljungstrom Air Preheater

- **Size for size, recovers more heat than any other type.**
- **Reduces fuel consumption. Permits use of lower-grade fuels. Increases boiler output and reliability.**
- **Eliminates cold spots . . . keeps corrosion to a minimum.**
- **Easier, faster to clean and maintain.**
- **Requires far less supporting steel and is quickly erected.**

The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

For more data circle 547 on Post Card



BOWSER ESTABLISHED 1885 EQUIPMENT for LIQUID HANDLING

Bowser is the pioneer and leading industrial maker of oil and process liquid control equipment. Bowser engineers work closely with plant engineers to assure specification of an efficient system for every need.

FLOW SIGHTS

One of several styles used in leading plants.

METERING

RECORDING PRINTER ON METER FOR ACCOUNTING RECORDS

INDUSTRIAL LIQUID METER

Control receipts and consumption of many liquids. Bunker C thru light distillates.

FILTERING

PROTECT FUEL INJECTORS WITH A GOOD FILTER

Bowser fueloil and process liquid filters contain replaceable cartridges that deliver a polished filtrate at low cost. Used by many leading railroads, petroleum marketers and many industrial users.

FOR PETROLEUM LIQUIDS

OIL CONDITIONING

A Bowser system keeps turbine oils dry and clear. Stops bearing failures. Oil lasts longer. The best insurance for power plants.

. . . for power generating equipment!

Mail Coupon Today For Catalog Data . . .

BOWSER ESTABLISHED 1885 BOWSER, INC., FORT WAYNE, IND. 1351 E. CREIGHTON AVE.

FUELOIL METERS	☐
PROCESS METERS	☐
FLOW SIGHTS	☐
FUELOIL FILTERS	☐
OIL CONDITIONERS	☐
LUBE OIL SYSTEMS	☐
BARREL PUMPS	☐

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

For more data circle 548 on Post Card

Letters

continued from page 108

with the intention of being critical but, instead, are submitted purely from the informative point of view. — *Albert A. Zalis, Warren, Mass.*

In reply, Koepf wrote to Zalis:

In preparation of the manuscript I was faced with a paradox. There is such a spread in performance characteristics of the various gear and screw pumps that I was forced to indicate limits to protect the designer from specifying conditions some pumps cannot meet in practice. Thus, the figures shown represent the range of 20 in. Hg vacuum to 300 psi, where most pumps in this service can be expected to operate. I have had several very satisfactory contacts with your products and readily agree that your equipment is capable of the conditions you describe. Please accept my apology for any adverse implications I might have conveyed. — *Almort H. Koepf, Burlingame, Calif.*

Comment on Stainless Steel Coal Ducts

To the Editor:

ARTICLE by J. L. Raymond, Stainless Steel Coal Ducts Stop Trouble in Maintenance and Operation, in your May, 1955 issue was very informative. I would like to add some comments, which you may find interesting.

Contacts with engineering personnel of public utilities and industrial power stations confirm Mr. Raymond's comments on the short life of carbon steel equipment. In coal hoppers and chutes handling coal fines which are wet at least occasionally, carbon steel has lasted as few as two years.

However, in suggesting the use of $\frac{1}{8}$" thick stainless steel to eliminate the difficulties occurring from corrosion, abrasion and stoppages when using carbon steel, it appears that Mr. Raymond is writing from experience gained only in his own operation. There is no data existing to justify the inference that gages in round ducts may be held to $\frac{1}{8}$". In fact, I can cite details of a comparable application where $\frac{1}{8}$" gage solid stainless was found to be structurally insufficient.

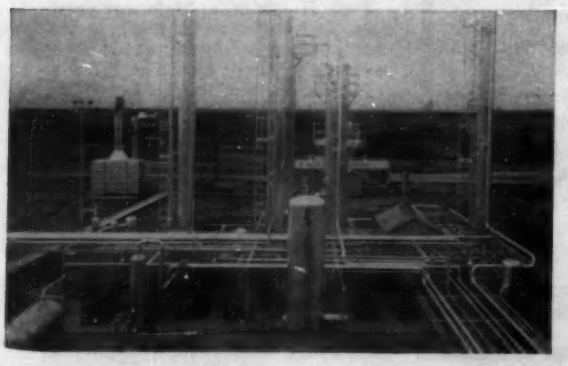
Where heavier gages, $\frac{3}{16}$" and higher, are needed for strength or rigidity, stainless clad steel shows an economic advantage. In material costs alone, this saving may run as high as 20 to 25 per cent.

In the case of coal scale hoppers and feeder hoppers, Mr. Raymond states that the lining of heavier gage steel with 16-gage stainless sheet has been found advantageous. For repair work or rebuilding, the choice between sheet lining or stainless-clad

it's easier to insulate pipe with Unibestos®

NO MATTER HOW COMPLEX THE PIPELINE, Unibestos insulation makes installation simpler. It's easily cut, mitered, or grooved for effective insulation of bends, expansion joints, ells, tees and other fittings.

Unibestos' unique construction provides greater protection against heat loss—even at the difficult joints—than other nonfibrous insulation. Amosite, the African long-fiber asbestos, gives Unibestos the extra strength to resist shock and vibration. And Unibestos has excellent chemical stability...withstands moisture, steam, acid or chemical fumes.



STANDARD PRODUCTION SIZES

Unibestos Pipe Insulation is regularly made in 3-foot lengths for pipe sizes from ½" through 24", in standard thicknesses through 5". Unibestos Block Insulation is made in 6", 12", 18" or 36" widths and in thicknesses from 1" through 3" in ½" increments.

For complete information, write for descriptive Bulletin 109C

UNARCO®

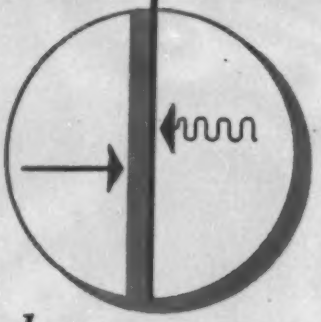
UNION ASBESTOS & RUBBER COMPANY

1111 West Perry Street • Bloomington, Illinois

For more data circle 549 on Post Card

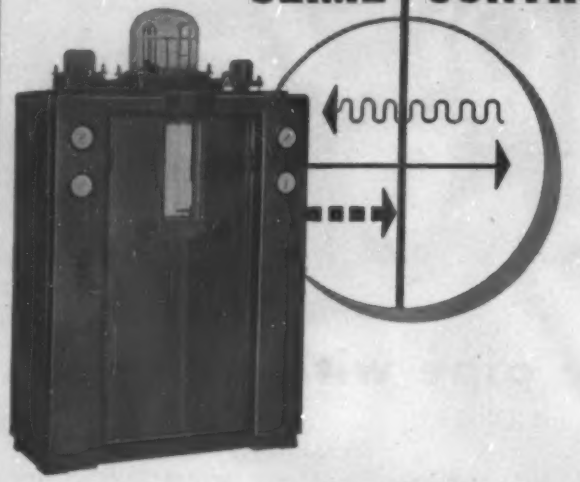
Where you need

HEAT | EXCHANGE



Be sure you have

SLIME | CONTROL



Whether you heat or cool water for make-up, process or any other use, you will need Wallace & Tiernan Chlorination to help combat slime problems introduced by water-borne bacteria or air-borne bacteria.

With slime control equipment designed for any need, built for lasting and dependable service, highly accurate and backed by over 40 years of successful application experience, Wallace & Tiernan Chlorination can help you increase the efficiency of your plant and cut operating costs. For further information write our Industrial Division.

WALLACE & TIERNAN

25 MAIN ST., BELLEVILLE 9, N. J.

CHLORINATORS • CHEMICAL FEEDERS • SCREENING EQUIPMENT • MAGNETIC SEPARATORS • PRECISION PRESSURE INSTRUMENTS • CATHODIC PROTECTION • FINE CHEMICALS

CD-39

For more data circle 550 on Post Card

Letters

continued from page 110

steel is a matter of economics and must take into account initial cost, maintenance costs, and service life. For new or replacement equipment, this same combination of factors indicates that integrally-bonded stainless-clad steel is the best means of obtaining the stainless surface.

Mr. Raymond has selected a very important subject for his paper, and I hope that my comments serve to complement his discussion. — *William H. Funk, Manager, Technical Service, Lukens Steel Company, Coatesville, Pa.*

OBITUARIES

John C. Mahoney

JOHN C. MAHONEY, who was widely known throughout the General Electric Co. and the utility industry, died in Schenectady, N. Y., after a brief illness. He was superintendent of G-E turbine installations for many years prior to his retirement in June, 1943.

Born in Anderson, Ind., November 27, 1877, he was employed by the General Electric Co. for over 40 years, first as a turbine erector in Atlanta, Ga., and later as a traveling turbine inspector. In this capacity he installed the G-E turbines which supplied power to operate the locks of the Panama Canal. In his later post as superintendent of turbine installations, he travelled extensively throughout the world to review turbine installation problems in such places as India, Gibralter, China, and Japan.

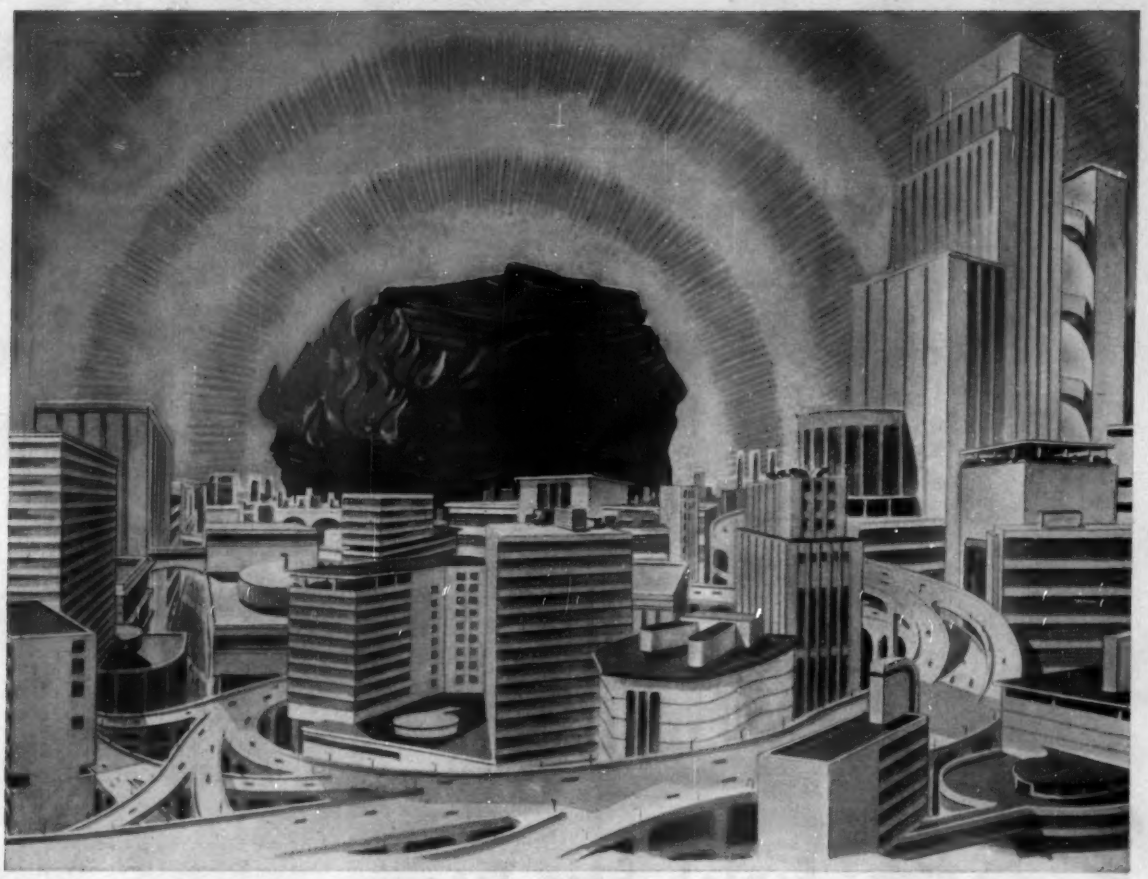
Since his retirement, he had divided his time between his home in Scotia, N. Y., and a winter home in Florida.

John H. Collier

JOHN H. COLLIER, 70, former president, and chairman of the board of Crane Co. died July 27, at his home in Fairfield, Conn., after a long illness.

Mr. Collier was president of Crane Co., Chicago, manufacturers of valves, fittings, plumbing and heating equipment, from 1941 to 1946. He served as chairman of the board from 1946 until Jan. 31, 1951. Since his retirement Mr. Collier had lived at Fairfield, Conn.

Mr. Collier joined Crane Co. in Chicago in 1903 after specializing in civil engineering at Purdue University which, in 1942, awarded him the degree of Master of Industry. His early assignments at the Crane Works



The fuel that sparked our nation's growth secures her greater future

A young America—primed by a new and power-packed fuel—became a great industrial giant almost overnight. Coal had supplied the first unwavering spark which was to grow into the brightest productive flame the world has ever known.

After being served so well in the past and present, America looks again to dynamic coal for greater prosperity and security in the future. The vast Bituminous fields along the Baltimore & Ohio contain excellent coals in wide variety—available for centuries to come.

BITUMINOUS COALS FOR EVERY PURPOSE

Highly mechanized mines, equipped and ready for any demands, will help maintain long-range cost stability. And improved utilization methods will meet the increased requirements of the future by providing greater coal-burning efficiency.

CALL ON OUR COAL TECHNICAL SERVICE

You'll receive complete information from trained B&O experts about the kind and size of Bituminous coal that fits your needs best—at a price you want to pay. Write:

COAL TRAFFIC DEPARTMENT
BALTIMORE & OHIO RAILROAD
BALTIMORE 1, MARYLAND

LIVELIHOOD TO GREAT STATES WITH THE B&O

Baltimore & Ohio Railroad

Constantly *doing things*—better!

For more data circle 551 on Post Card

But

Super Finish Stic-Tite

is Mighty Fast when it comes to

- Superior One-Coat Finish—Smooth — Clean — White — Attractive — Hard — Easy to paint or to coat for outdoors service.
- Greater Coverage — 80 sq. ft., ⅛" thick, per 100 lbs. of cement — double the coverage of asbestos cement.
- Best Adhesiveness — can be troweled to full thickness in one coat, saving time and labor and eliminating need for a roughing coat.
- Firmness — No Checking — No Cracking — No Shrinkage.
- Maximum Resistance to impact and abrasion, water and steam.
- Excellent Insulation at temperatures to 1700° F.

Super Finish Stic-Tite Insulating Cement is truly your best hard finish covering for insulating block, blankets and other insulating bases on flanges, fittings; short runs of pipe; boiler, tank, fan and heater surfaces.

Packed in 25-lb. bags. Weighs only 30 lbs. per cu. ft. Ask for sample bag. You'll be convinced.

REFRACTORY & INSULATION CORP.

R&I

REFRACTORY BONDING AND CASTABLE CEMENTS
INSULATING BLOCK, BLANKETS AND CEMENTS

130 WALL STREET • NEW YORK 5, N. Y.

For more data circle 552 on Post Card

Obituaries

continued from page 112

in Chicago were varied, ranging from core maker's assistant to machine designing. During the planning and construction of the huge Chicago Works at 4100 S. Kedzie Ave. from 1913 to 1917, he was special assistant on general construction.

After completion of the Chicago Works in 1917 he was appointed general manager of the Bridgeport, Conn., manufacturing division and subsequently was elected a director of the company. In 1929 Mr. Collier went to Europe to head Crane operations in England and France. In 1933 he was elected vice president of manufacturing with headquarters at the Chicago Works which he helped to build years before. This position he held until his election as president of the company in 1941.

Mr. Collier was a former trustee of the Illinois Institute of Technology.

Surviving are his wife, Mrs. Virginia MacMakin Collier; a daughter, Mrs. Joan H. Collier Donofrio; a son, MacMakin Collier and six grandchildren.

NEW ENGINEERING BOOKS

Applied Atomic Energy by K. Fearnside, E. W. Jones and E. N. Shaw. First Edition, 156 pages, 5 by 7½ in. cloth, published by the Philosophical Library, 15 East 40th St., New York, N. Y. 1954. Price, $4.75.

This little book of only 156 pages is one of the most informative and readable books on the practical applications of Atomic Energy that has come to our attention thus far. It deals primarily with the use of radioactive isotopes in industry and biology, but the first part of the book gives an excellent description of the basic elements of nuclear fission and design of nuclear reactors in terms that the average reader can easily grasp.

In preparing this book, the authors acknowledge the cooperation and assistance they received from the staff of the atomic energy research establishment at Harwell, England, and, in particular, that of Dr. Henry Seligman, Head of the Isotope Division at Harwell. As the authors point out, although America had a very long start in the use of isotopes owing to the fact that the first atomic piles were built in this country, the production and uses in Britain have made great strides in the past few years, and it is believed that in some respect Britain is now ahead of America. This result is almost entirely due to the freedom with which isotopes are obtainable from Harwell by properly accredited scientific workers and to the encouragement given to scientists to use radioactive isotopes by the Isotope

SAVE MONEY AND PROTECT YOUR PLANT BY

Installing Hancock 1500# and 2500# Steel Valves and assuring dependable leak-proof service

Put an end to the costly hazards of valve leakage in your high-pressure, high-temperature steam plant! Let proved-in-the-line Hancock 1500# and 2500# Valves assure the safe, reliable performance so essential to protect personnel, plant and service to customers.

Hancock 1500# and 2500# Steel Valves are preferred by most design and operating engineers in modern steam plants for very practical reasons. There is no bonnet joint to leak, no gasket to leak, no seat insert to leak! In fact, these rugged valves have every design, quality and construction feature essential for the severest services. Get complete information, then try one of these heavy-duty valves. You will soon agree that . . .

When Hancocks go in, valve costs go down!

SIZES:

¼" through 2"
Outside Screw
and Yoke

SERVICE RATINGS:

Screwed and Socket Weld Ends: For all pressures up to 2500 psi at 1050° F., O.W.G. 6000 psi—100° F.

Flanged Ends: For all pressures up to 1500 psi at 900° F., O.W.G. 3600 psi—100° F.

YOUR INDUSTRIAL SUPPLY DISTRIBUTOR is as close as your telephone. You can depend on his recommendations and service to save you time, trouble and expense.

In Canada: *Manning, Maxwell & Moore of Canada Ltd., Galt, Ontario*

HANCOCK VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** Watertown 72, Massachusetts

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, Stratford, Conn. 'CONSOLIDATED' SAFETY RELIEF VALVES, Tulsa, Okla. AIRCRAFT CONTROL PRODUCTS, Danbury, Conn. and Inglewood, Calif. "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, Muskegon, Mich.

For more data circle 553 on Post Card

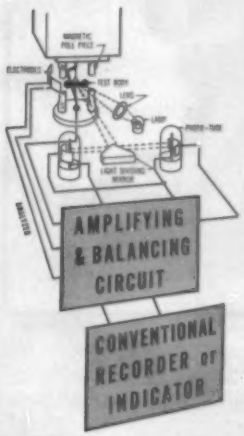
NEW
Arnold O. Beckman
MODEL F3
OXYGEN ANALYZER

with the meter on the door

New convenience has been built into the well-known F3 Oxygen Analyzer...a meter on the door provides readings at the sampling point for making calibration checks, process changes, etc. In fact, complete analyzing, calibrating and indicating components are now incorporated into the single F3 unit—at no extra cost!

Use The Model F3
ON OPERATIONS LIKE THESE...TO MAKE SAVINGS LIKE THESE

COMBUSTION Boilers, Kilns, Direct-Fired Heaters, Stills, etc.	*Higher combustion efficiencies at lower fuel costs*
PROCESSING Air Liquifraction . . . Processing Butadiene, Acetylene and Similar Gases	*Better product quality with minimum oxygen or air contamination*
PLANT SAFETY Hydrogenation, Hydrofining, Gas Compressors, Sulfur Grinding, etc.	*Control explosive atmospheres, reduce fire risks, minimize plant and personnel hazards*



Unique Operating Principle

The various applications highlighted above are only a few of the many ways Arnold O. Beckman Oxygen Analyzers—industry's great new profit builders—are being used by progressive operators to boost profits, cut costs.

These are the *only* oxygen analyzers that *continuously* measure process streams by an advanced magnetic principle that provides *direct physical measurement of the oxygen itself*—not of some secondary relationship.

Heart of the unit, as illustrated, is a dumbbell-shaped test body suspended in a magnetic field. Sample gas surrounding this test body causes it to rotate in the field, depending upon the oxygen content of the gas. The movement of a light beam, reflected by a small mirror on the test body, is measured by simple electronic circuits . . . and the result indicated directly on a conventional recorder or indicator. It's simple, positive, accurate!

No chemicals—filaments—catalysts cams—complicated mechanical parts!

***Send for Helpful Free Literature** which describes this unique operating principle in detail—explains its many advantages and applications. When writing, outline your particular operations—we'll gladly supply specific information.*

Ask For Data File 16D-95

FEATURES OF THE F3

Many Ranges: Full scale ranges of 0-5%, 0-10%, 0-15% O_2 and higher.
Accuracy: 1% of full scale.
Multi-Ranges: Any instrument may be supplied with two or more ranges.
***Note:** For ranges narrower than 0-5% O_2 ask about the Model G2.*

Arnold O. Beckman INC.
Instruments for Science and Industry
1020 MISSION STREET
SOUTH PASADENA, CALIFORNIA

See Our Booths #419-420 at the September ISA Show.
For more data circle 554 on Post Card

Engineering Books

continued from page 114

Division at Harwell. Dr. Seligman, Head of this Division, under the direction of Sir John Cockcroft, has pursued an energetic policy of popularizing the use of isotopes and of advising potential users on the best approach to their problems.

This book provides a background knowledge of nuclear physics necessary to an understanding of the advantages to be derived from these techniques and it discusses a large number of applications to different fields of pure and applied science, including radiography techniques and the use of isotopes in pure research, in biological work, industrially, for medical purposes, and in agriculture.

It also discusses the prospect of useful power generation and problems of international control. Not the least important is Chapter 5, which discusses the legal aspects of atomic energy, particularly with respect to Great Britain. We have no hesitation in recommending this book to the laymen and to the scientific worker specializing in fields other than nuclear physics.

★ ★ ★

Linear Transient Analysis, Volume 1. First Edition, 1954; 348 Pages 6 by 9 in. cloth; John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Price, $7.50.

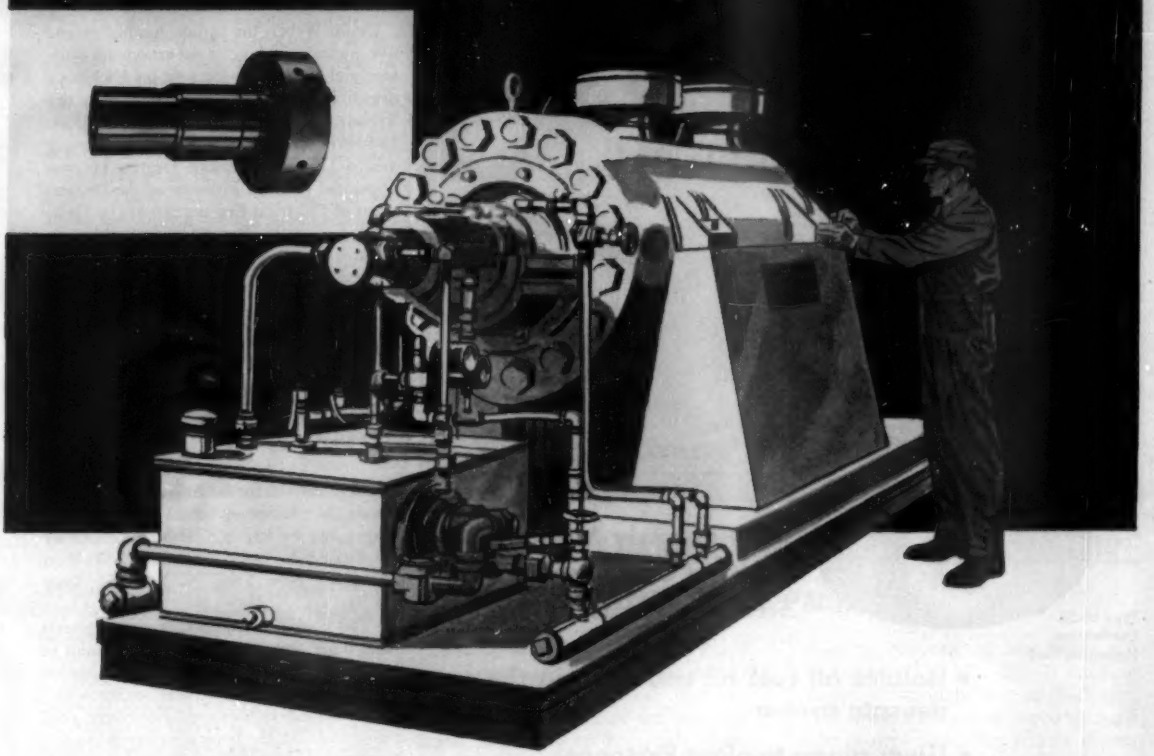
Experience has shown that advanced textbooks can be useful at two periods of the development of a new field; near the inception of the development when everybody interested in the field would like to learn about it in the quickest manner; and past the climax of that development when careful reflection and comparison of methods are possible.

The timing of this book classifies it as typical of the second category. In it will be found an equal treatment of all methods of transient analysis. Indeed emphasis is laid on the fact that no one method of treatment should be considered as unqualifiedly better than others, thus the book presents an extensive and critical review of classical and operational methods of analysis before entering upon the Laplace transform and Fourier integral methods. The fundamental exposition of each method is accompanied by many illustrations of the applications to practical circuit problems.

This volume is devoted to lumped-parameter, two-terminal networks. The first chapter examines the circuit concept and its relation to the electromagnetic field phenomena in terms of the underlying physical concepts and relations. The second chapter reviews the classical formulations of transients in Linear networks by means of integro-differential equasions.

Because of the increasing importance of the circuit concept in mechanical and thermo systems, chapter three treats analogs from a fundamental point of view with many illustrated examples. Chapter four presents Heaviside's operational methods with the

Now... BJ mechanical seals for high pressure boiler feed pumps!



Another Byron Jackson first!

- **No operating adjustment**
- **Stop liquid loss**
- **Reduce heat loss**
- **Save downtime costs**
- **Cut replacement costs**

BJ . . the pacemaker in mechanical seals for pumps . . . now has pioneered the first successful application of the mechanical seal to high pressure boiler feed pumps. These new BJ Mechanical Seals are now in operation in a number of high pressure, hot water pumping operations, including temperature up to 430° F. These seals—some in service as long as three years—have paid off in performance. They have minimized heat and liquid loss, eliminated frequent repacking problems, and simplified maintenance since no operating adjustment is required. Find out how these new BJ Mechanical Seals for boiler feed pump service can benefit you. Contact your nearby Byron Jackson office or write.

You'll do better with BJ

Byron Jackson Co.

Since 1872

P. O. BOX 2017, TERMINAL ANNEX, LOS ANGELES 54, CALIFORNIA

For more data circle 555 on Post Card

IT'S NEW!

Paracoil OIL-LEAK DETECTION SYSTEM

for STEAM TYPE FUEL OIL HEATERS

Type LP-20
Condensate
Inspection Tank

Continuously Monitors the Purity of Condensate leaving Steam-Type Fuel Oil Heaters

- Isolates all fuel oil entrained in the condensate stream
- Gives alarm to plant Personnel
- Protects the boiler by removing oil contamination from feed-water cycle
- Applicable to both low and high pressure steam plants
- Engineered to the special requirements of each installation

Write for further details

DAVIS ENGINEERING CORPORATION

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y. • 1064 EAST GRAND ST., ELIZABETH 4, NEW JERSEY

Since 1915 . . . Paracoil's skill to do comes of doing . . . Since 1915

For more data circle 556 on Post Card

Engineering Books

continued from page 116

modification given it by H. Jeffreys, which permits a rigorous systematic and self-consistent development. The Laplace transform concept is introduced in chapter five. The final chapter establishes the frequency spectrum concept and illustrates the transition from the discrete spectra of periodic functions to continuous spectra of non-periodic functions, paralleling the transition from Fourier series to Fourier integrals. The needed mathematical background for various sections is reviewed in appendices.

Ernest Weber, the author, has had extensive academic and industrial experience both here and abroad. He received his Bachelor's degree in Electrical Engineering from the Technical University in Vienna in 1924. In 1946 he earned his Ph.D. and the following year a Doctor of Science Degree. He was appointed Adjunct Professor in the Department of Electrical Engineering of the Technical University Berlin-Charlottenburg in 1949, and the next year became Visiting Professor of Electrical Engineering at Polytechnic Institute in Brooklyn in charge of graduate study and research in Electrical Engineering. Today Professor Weber is Head of the Department of Electrical Engineering and Director of the Micro-wave Research Institute at Polytechnic Institute of Brooklyn.

★ ★ ★

Modern Physics for the Engineer. Edited by Louis N. Ridenour. First Edition, 500 pages, 6¼ by 9¼ in.; cloth. Published by McGraw-Hill Book Co., Inc. 330 West 42nd St., New York, N. Y., 1954. Price $7.50.

This book was compiled to give engineers and other technical men a brief account of some of the more interesting developments in the fundamental physical science which underlies all engineering. Relatively non-mathematical, the book is authoritative and interesting. It provides a treatment of various branches of physics which is neither a collection of monographs for the specialist nor a popular account for the completely uninformed. Rather, it is something in between. The treatment assumes a general familiarity with the methods and results of physical science, but no specialized knowledge of the subjects covered.

Actually, the book is the work of 20 specialists including the editor, Dr. Ridenour. The material comprises a collection of lectures delivered to an extension course at the University of California, Los Angeles, during the year 1952–1953. Topics treated include: Relativity and the Foundations of Mechanics, Atomic structure, Physics of the solid state, Magnetism, Microwave spectroscopy, Nuclear structure and Transmutation, Electronuclear machines, The Actinide elements and nuclear power, Elementary particles, Astrophysics, High-pressure phenomena with Applications to Geophysics, The Earth Be-

neath the Sea, Thunderstorms and Lightning Strokes, Transient phenomena in supersonic flow, Electrons and Waves, Semiconductor electronics, Communications theory and the Transmission of information, and computing machines and the processing of information.

A most interesting and valuable book.

★ ★ ★

Electromagnetic Theory, by V. C. A. Ferraro; First Edition 1954; 555 pages; 6 by 9 in., cloth; published by the Athlone Press, University of London, distributed in U. S. by John De Graff, Inc., 64 West 23rd St., New York, N. Y. Price $7.00.

This book contains the substance of lectures on electricity and magnetism delivered over a number of years at King's College, London, and is intended for the use of students reading for an Honor's Degree in Mathematics.

The need for a textbook to fill the gap between the more elementary treatises and those which go far beyond the syllabus of an Honor's Degree has long been felt, and the author has aimed at giving a rigorous account of the subject with the fundamental principles clearly stated; although the book has been written primarily for mathematicians, it should also be of use to physicists and electrical engineers.

The volume is divided into three parts; the first dealing with electro-statics and magneto-statics. The second with the solution of so called boundary value problems involving the use of special mathematical methods, and the third with electrodynamics.

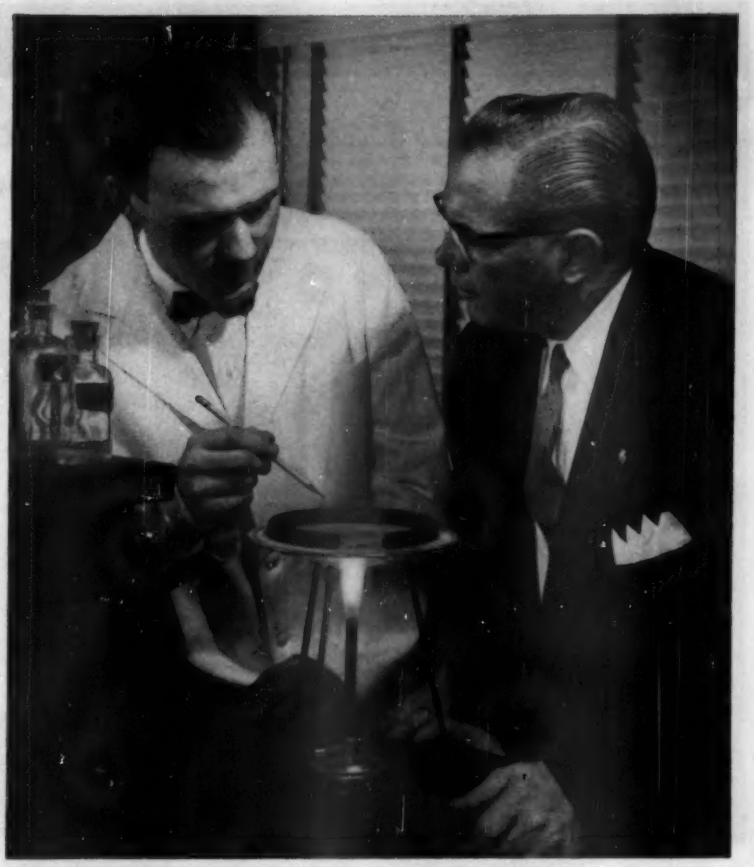
The author is Professor of Mathematics at Queen Mary College in the University of London

★ ★ ★

Nuclear Physics by W. Heisenberg. First Edition, 225 Pages, 5 by 7¾ in. The Philosophical Library, Inc., 15 East 40th St., New York, N. Y. 1953, Price $4.75.

This little book by one of the outstanding physicists of our time begins with a short and interesting history of the views about atoms in antiquity and also of the development of atomic theory until the close of the 19th Century. The next chapter is devoted to molecules and atoms. Among other things it deals with Bohr's theory, the periodic system and the extra-nuclear structure of atoms. The way is thus prepared for the main subject of the book, which includes radioactivity, the binding energy of nuclei, nuclear structure, artificially induced nuclear transmutations and with the methods of observation and of producing nuclear transmutations. The work concludes with an account of some of the practical applications of nuclear physics.

The distinguished author manages to convey a great deal in simple language and without mathematics. He does not claim to have brought the subject quite up to date, but regards this little book as a tentative and provisional introduction to a subject — the domain of which is being continuously and rapidly expanded.



LOCKED-IN LUBRICATION IMPORTANT FEATURE

OF R/M's BIG 7 PACKING TYPES

The lubricants in R/M's Big 7 Packing Types are ground in during manufacture—they are not just surface coatings. Heat can not dissipate them. Pressure can not force them out. They are locked in so securely that even after the packing starts to wear, the bearing surface remains the same. Superior lubrication, however, is but one of the many advantages of R/M's Big 7 Packing Types. By standardizing on this basic, custom-built line—you probably need only 3 or 4—you can reduce downtime, cut costs, lower inventories, simplify ordering. To find out how, ask your R/M distributor for the R/M Big 7 Recommendation Chart.

R/M's BIG 7 PACKING TYPES MEET 95% OF ALL PACKING NEEDS

R/M Packings for maintenance purposes are sold only through authorized R/M distributors

R/M BIG 7 PACKINGS

RAYBESTOS-MANHATTAN, INC.

PACKING DIVISION, PASSAIC, N.J.

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Passaic, N.J.; Neenah, Wis.; Crawfordsville, Ind.; Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Packings • Asbestos Textiles • Industrial Rubber, Engineered Plastic, and Sintered Metal Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks Clutch Facings • Fan Belts • Radiator Hose • Bowling Balls

For more data circle 557 on Post Card

. . . for LOW COST STEAM TOMORROW
buy a SUPERIOR STEAM GENERATOR TODAY

Superior Steam Generators encompass the most complete line of packaged boilers available. Write for complete details today.
Fire Tube types to 600 b.h.p. (Write for Catalog 706 F).
Water Tube types to 45,000 lbs./hr. (Write for Catalog 706 W).

Man will reach the moon . . . tomorrow perhaps . . . but more than likely "tomorrow" in the dictionary of scientists means 20 years . . . and that's a long time to pay the penalty of high steam costs. A boiler is a long term investment; and the equipment you buy today determines your steam costs for years to come.

Superior Steam Generators are designed and built to last longer, and to operate at higher efficiencies throughout their entire serviceable life. Evidence of this you can see for yourself in Superior's bigger, heavier construction and completely integrated design. Superior Steam Generators provide more steam per dollar over a longer serviceable life.

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR
STEAM GENERATORS

For more data circle 558 on Post Card

CATALOG LIBRARY

Standard catalogs listed monthly to help you maintain a reference library

BOILERS, GENERATORS

201 Shop-Assembled Boiler — Sixteen-pp Bulletin G-76 completely describes and illustrates company's Type FM water-tube integral-furnace boiler, made in standard sizes from 2900 to 28,000 lb of steam per hr, pressure to 250 psi. The Babcock & Wilcox Co.

202 Packaged Boilers — This 16-pp illustrated catalog describes manufacturer's new Type VP package boiler. Following a section of background information is an outline of the principal design features of these boilers, which are shop assembled and provide steam capacities from 4000 to 30,000 lb per hour. Space requirements are shown in a table along with typical specifications. Also described is control system. Combustion Engineering, Inc.

203 Standard Boilers — Eight-pp Bulletin WT-8 describes company's "S" series of boilers with capacities ranging from 10,800 to 50,000 lb. Lists data and specifications on each of the models and sizes, and discusses general design features and special "S" type construction features. Wm. Bros. Boiler & Mfg. Co.

204 Self-Contained Boilers — Bulletin AD-144 reviews company's new CB boilers. Illustrations include installations, demonstrations. Engineering articles are featured covering such subjects as low noise level. Cleaver-Brooks Co.

205 Improved Steam Generator — Bulletin 2000, 28 pp, explains advance design features that distinguish this manufacturer's generator from other unit steam generators. Describes and illustrates engineering differences of component features. Also shows how these components are constructed, assembled and tested. Another section gives data, and dimensions for the units which range from 20 to 6000 hp. Preferred Utilities Mfg. Corp.

It's easy to get these free catalogs — just circle item numbers of those wanted on the postcard at right.

206 Steam Generators — Illustrated Bulletin SB43, 20 pp, describes company's VL factory assembled generators combining 2-drum water-tube boiler, integral water cooled furnace, brick work, insulation and steel casing. A large cutaway illustration shows design details, and gas travel. Erie City Iron Works.

207 Steam Generator — This manufacturer's new Type D steam generator, a packaged unit for pressure firing with gas,

SEPTEMBER, 1958

Card void after March 31, 1958

POWER ENGINEERING

Please have the manufacturers send me without obligation information or bulletins indicated by the numbers circled below.

Name.....Title.....

Company Name.....
(Must be included)

Company Address.....

City.....State.....
(If you prefer delivery at home, give home address, too)

Home Address.....

City.....State.....

Equipment

| | | |

oils or combination of fuels, is described in an 8-pp catalog. Gives complete data and dimensions on this water tube generator which is available in 17 sizes with capacities from 8000 to 40,000 lb of steam per hour. Fully illustrated, booklet explains economical steam production, low installation cost, other advantages. Superior Combustion Industries Inc.

208 Automatic Boilers — This bulletin describes 17 sizes of Powermaster packaged automatic boilers from 15 through 500 hp for steam process, steam and hot water heating service. Lists such advantages as three-pass design, forced draft and automatic controls. Describes firing equipment for light and heavy oils, gas; shows various fuel firing arrangements. Orr & Sembower, Inc.

TUBING AND ACCESSORIES

209 Condenser Tubes — Excellent information on condenser tubes and their service life is given in this 40-pp illustrated booklet. Subjects discussed include corrosion of condenser and heat exchanger tubes, corrosion resistance and control, the selection of tube materials, and the composition and physical properties of company's alloys. Gives details on proper installation. Scovill Mfg. Co.

210 Rotary Tube Cleaners — Bulletin R-105 presents air and water driven rotary tube cleaners and cleaner accessories. Illustrates several models and heads. Roto Div., Elliott Co.

211 Nickel Pipe and Tubes — Bulletin T-17 is a 28-pp technical bulletin on the fabrication and design of nickel and high nickel alloy pipe and tubing, illustrated throughout by drawings and photos. Presents tables on mechanical and physical properties, ASME code requirements, recommended welding procedures. The International Nickel Co., Inc.

212 Tube Cleaners — Catalog 76-A provides 48 pp of information on manufacturer's line of tube cleaners. Following equipment selection and operating hints, this practical catalog describes and pictures cutter heads and drill heads, brushes, and motors, giving sizes, application information. Air valves, hose, lubricators are described. Thomas C. Wilson, Inc.

213 Life Extension for Condenser Tubes — The 32-pp current edition of this booklet reports on research into the causes of corrosion and means of combating them, as well as the choice of condenser tube materials. Points out that Admiralty metal, long a standard for power plant condenser tubes, works satisfactorily in most installations, but other alloys may be necessary in some circumstances. Revere Copper and Brass, Inc.

COAL, ASH HANDLING

214 Burning Bituminous Coal — This 24-pp illustrated booklet is a compilation of numerous actual case histories of industrial plants and institutions which burn bituminous coal "the modern way." Stressing operating economy achieved, these case histories show problems overcome, equipment used, and savings realized. Bituminous Coal Institute.

215 Spreader Stoker — Sixteen-pp Bulletin 800 describes manufacturer's Type C-C RotoStoker, a relatively small spreader stoker offering continuous clean-

SEPTEMBER, 1958
Card void after
March 31, 1958

POWER ENGINEERING

Please have the manufacturers send me without obligation information or bulletins indicated by the numbers circled below.

Name.....Title.....

Company Name.....
(Must be included)

Company Address.....

City.....State.....
(If you prefer delivery at home, give home address, too)

Home Address.....

City.....State.....

Equipment				Helpful Bulletins							Catalog Library										
1	2	3	4	101	102	103	104	105	106	107	201	202	203	204	205	206	207	208	209	210	211
5	6	7	8	108	109	110	111	112	113	114	212	213	214	215	216	217	218	219	220	221	222
9	10	11	12	115	116	117	118	119	120	121	223	224	225	226	227	228	229	230	231	232	233
13	14	15	16	122	123	124	125	126	127	128	234	235	236	237	238	239	240	241	242	243	244
17	18	19	20	129	130	131	132	133	134	135	245	246	247	248	249	250	251	252	253	254	255
21	22	23	24	136	137	138	139	140	141	142	256	257	258	259	260	261	262	263	264	265	266
25	26	27	28	143	144	145	146	147	148	149	267	268	269	270	271	272	273	274	275	276	277
29	30	31	32	150	151	152	153	154	155	156	278	279	280	281	282	283	284	285	286	287	288
33	34	35	36	157	158	159	160	161	162	163	289	290	291	292	293	294	295	296	297	298	299
37	38	39	40	164	165	166	167	168	169	170											
41	42	43	44	171	172	173	174	175	176	177											

Advertised Products and Services																					
501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521
522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542
543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563
564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584
585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605

Use this space to ask for tear sheets and other information.

BUSINESS REPLY CARD
No Postage Stamp Necessary If Mailed in the United States

POSTAGE WILL BE PAID BY—

POWER ENGINEERING

110 South Dearborn

CHICAGO 3, ILLINOIS

FIRST CLASS
PERMIT No. 353
Sec. 34.9 P.L.&R.
CHICAGO, ILL.

3:59.4 or 4:01.4

There's enough difference To make all the difference

A difference of only 2 seconds . . . but it made sports history on May 6, 1954, when the first under-four-minute mile was run in Oxford, England.

The differences in quality and performance that Scovill builds into its Heat Exchanger Tube, while they also may seem small, can make a *big* difference in improving your operating record. Scovill Phosphorized Admiralty Heat Exchanger Tube, for example, begins its long service life with an added advantage. It is initially hot-extruded from billets *continuous-cast* by Scovill's pioneer process. This means sounder metal — smooth, dense, free from pits or porosity. It means new uniformity of chemical composition, with optimum and uniformly distributed phosphorus content.

The next time you have a new installation or a re-tubing job, let us show you how these differences in Scovill Heat Exchanger Tube work for you.

Scovill Manufacturing Company, Mill Products Division, 99 Mill Street, Waterbury 20, Connecticut. Phone PLaza 4-1171.

SCOVILL **HEAT EXCHANGER TUBE**

Phosphorized Admiralty • Admiralty • Arsenical Admiralty • Muntz Metal • Naval Brass • Red Brass, 85% • Deoxidized Copper
Arsenical Copper • Copper Nickel, 10% & 20% • Cupro Nickel, 30% • Aluminum Brass • Aluminum Bronze, 5% • Duplex Tube

133C55

For more data circle 559 on Post Card

ing and ash discharge advantages of larger units, without need of a basement for ash-removal. Explains this and other operational advantages of the stoker, which is adapted to modern steam boilers with output capacities of about 5000 to 75,000 lb of steam per hour. Detroit Stoker Co.

216 Fly Ash Collection — The successful and economical separation of fly ash from boiler flue gases is discussed in 28-pp Catalog G405. Explains need for collection equipment and gives physical characteristics of fly ash. Describes company's Multiclone equipment as to principle of operation, performance and advantages. Western Precipitation Corp.

217 Spreader Stoker Selection — Fourteen-pp Form F-520-A10M is intended to help those choosing a spreader stoker to get the most for their investment, and it points out many factors to be considered. American Engineering Co.

PUMPS, COMPRESSORS

218 Boiler Feed Pump — A barrel-type boiler feed pump for high pressure, high temperature service and designed to go on the line quickly without preliminary warm-up is the subject of 12-pp Bulletin 1525. De Laval Steam Turbine Co.

219 Gear Pumps — Besides presenting all of company's standard gear pumps, 24-pp Bulletin 17-A describes briefly some special types engineered for unusual requirements. Discusses design, construction and operation of the pumps; tells how they're used in the power and industrial fields. Drawings, action photos, capacity and pressure tables and performance data supplement the text. Booklet covers pumps ranging from 1 gph to 1000 gpm capacities. Schutte and Koerting Co.

220 For Abusive Pumping Jobs — Catalog 4906, 36 pp, covers centrifugal pumps for wide industrial use and especially adapted to handling ashes, abrasive mixtures, slurries, hot and corrosive liquids. It describes several basic types: a horizontal shaft, single-stage side suction pump; a horizontal shaft, single-stage, rear-entrance automatic priming pump; vertical shaft pumps with standard, overhead and quill bearings for wet pit applications. Nagle Pumps.

221 Sump Pump Selector — Bulletin 54-3-1420, 20 pp, provides a selection table allowing a power engineer to choose any of the 4000 models of the BJ Sumpmaster pumps, which range from 10 to 2600 GPM with heads from 20 to 300 ft. Includes complete dimensions and outline drawings. Byron Jackson Co.

222 On Vertical Pumps — Sixteen-pp Bulletin describes and illustrates application of vertical industrial service pumps for liquid transfer from short settings in both industrial and process services. Points out advantages and describes three basic designs. Stresses versatility of the pumps due to design flexibility. Also gives general recommendations for obtaining optimum performance, and includes photos of typical installations. Peerless Pump Div., Food Machinery and Chemical Corp.

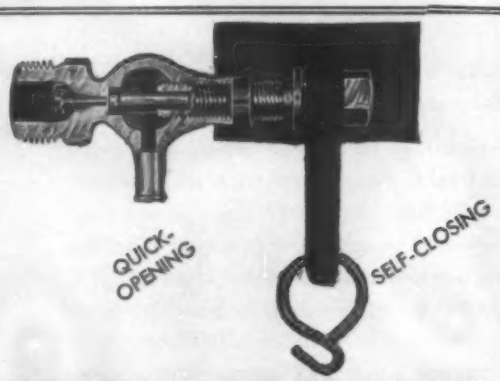
223 Balanced Opposed Compressors — Engineering data on company's balanced opposed compressors, 3000 to 10,000 hp (top range in tandem arrangement) is contained in 36-pp Bulletin L-679-B1. Presents information on operation, drives, design features, running gear, lubrication, valve action, capacity control, coolers and accessories. A chart listing approximate dimensions is included, along with photos of compressor installations. Worthington Corp.

WATER CONDITIONING

224 Handbook on Demineralizing — Comprehensive 40-pp Bulletin 5800-B compares various methods of water treatment, indicating the comparison between demineralizers and evaporators. It discusses the characteristics of the various types of available cation and anion exchange materials and offers data on operating costs of demineralizing. It tells when to use 2-bed, 3-bed, 4-bed, mixed or mono-bed demineralizers. It also indicates when decarbonators or vacuum deaerators should be installed. Cochrane Corp.

225 Modern pH and Chlorine Control — This 100-pp booklet gives details on color comparators and equipment in water testing and control of boiler and industrial process water, also technical information on meaning of pH control, electrometric and colorimetric methods of determining pH and impurities in water; applications of water control in air conditioning; feedwater. W. A. Taylor & Co.

226 What's What on Ion Exchangers — Here are three booklets on ion exchangers: Nalcite HCR, a styrene type cation exchanger; Nalcite SAR, a strongly basic anion exchanger; and Super Nalco-



"PBH" GAUGE COCK

A gentle pull opens this sturdy, long-wearing gauge cock and an adjustable weight automatically closes it when you let go. Removable monel metal seat and copper valve pencil insures leak-tight service.

Write today for catalogue and prices

The PAUL B. HUYETTE CO., Inc.

401 N. BROAD ST. EST. 1896 PHILADELPHIA, PA.

WATER GAUGES—Vertical and Inclined
GAUGE-GLASS PROTECTORS • AIRTITE
BOILER WALL COATING • WATER COLUMNS •
BOILER ALARMS, INSTRUMENTS & CONTROLS

For more data circle 560 on Post Card

KOR

pronounced "core"

THE MOST POWERFUL FUEL OIL CONDITIONER EVER MADE

NON-EXPLOSIVE — ALKALINE SAFE (KEEPS ALL BOILER HEATING SURFACES CLEAN) QUICK ACTING NON-ACID NON-CORROSIVE — RUST RESISTANT

"Kor" meets the mandatory requirements specified for an acceptable fuel oil treatment which thereby makes it officially approved for use for conditioning all grades of oil fuels, including that for Diesels, and petroleum pitch.

Send for performance proofs, bulletins, and prices

KOR CORPORATION

Division of Oxi Corporation

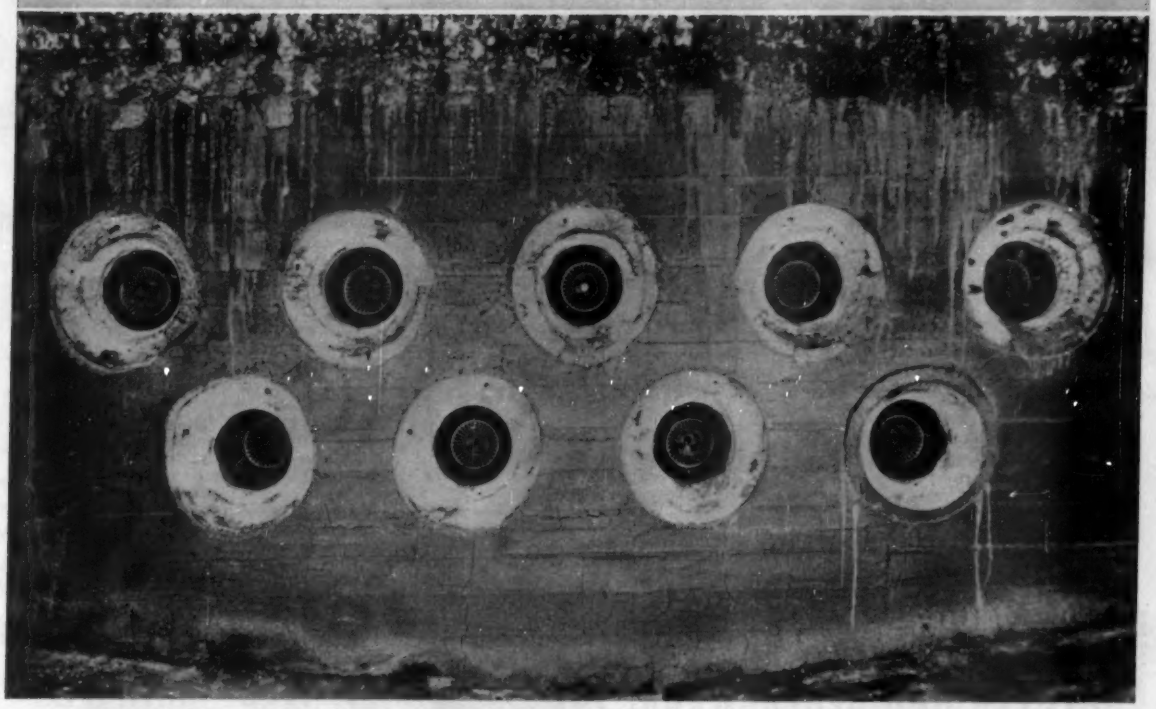
MANUFACTURING, ENGINEERING, AND COMBUSTION SPECIALISTS

600 WEST 9th AVENUE, GARY, INDIANA

For more data circle 561 On Post Card

Longer-lasting boiler wall quickly made with...

REFRACTORY CONCRETE



BURNER WALL in excellent condition after a year of service in a 100,000 lb./hr. steam boiler at station "B," San Diego Gas and Electric Company. This monolithic refractory concrete burner wall is made with TASIL HYDROCAST #401, a 3000°F. castable refractory manufactured by The Chas. Taylor Sons Co. (A Subsidiary of National Lead Co.), Cincinnati, Ohio.

YOU MIGHT EXPECT this front wall to be ready for replacement. Over a year old, it has already outlasted previous burner walls on a 100,000 lb.-per-hour steam generator. But it is made of Refractory Concrete, and it's in such good condition that the form marks are still clearly defined.

Long service like this is typical of Lumnite* Refractory Concrete. Its low volume change and ability to take over 2600°F heat result in maintenance economies. And consider the other savings:

Less time and labor are needed because Refractory Concrete is placed easily as a monolithic unit... reaches service strength within 24 hours. Special shapes can be cast on demand so inventories of special shapes are reduced. For instance, burner ports here are cast with the base—no special shapes and complicated fitting needed.

You'll find Refractory Concrete excellent for use wherever heat, corrosion or abrasion is a problem. It is readily made with Lumnite calcium-aluminate cement and refractory aggregates.

FOR CONVENIENCE, use a prepared castable mix such as the one that was used on the job shown above. Most castables are Lumnite Cement plus aggregates selected for specific temperature and insulation service – add only water. They're made and distributed by leading manufacturers of refractories. For more information, write Lumnite Bureau, Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, New York.

**"LUMNITE" is the registered trade-mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.*

PE-C-55

ATLAS® **LUMNITE for INDUSTRIAL CONCRETES**

REFRACTORY, INSULATING, OVERNIGHT, CORROSION-RESISTANT

A UNIVERSAL ATLAS PRODUCT

UNITED STATES STEEL HOUR—Televised alternate weeks—See your newspaper for time and station

For more data circle 562 on Post Card

lite, a synthetic gel type zeolite for cation exchange. Tables and graphs explain performance of these water treating resins under various operating conditions. Physical characteristics, exchange capacities, regeneration techniques discussed. Bulletin 57, 20 pp, is on Nalcite SAR; Bulletin 58, 28 pp, Nalcite HCR; Bulletin 59, Super Nalcolite. National Aluminate Corp.

227 Microbiological Control — Technical Article 3C, 12 pp, is an illustrated discussion of microbiological control of and through industrial waters. A section on industrial water chlorination covers cooling waters and process waters. Other sections deal with chlorine metering in chemical processes, and the sanitary aspects of industrial water treatment. Wallace & Tiernan Co., Inc.

228 Chemical Treating of Feedwater — Application Engineering Data Sheet D-54-3 discusses use of Hydrazine in treating feedwater for high pressure boilers. Tells how precise addition of this chemical to boiler feedwater maintains residual oxygen content at zero and also prevents ammonia accumulation in the system. Milton Roy Co.

229 Feedwater Treating — Bulletin 1855, 30 pp, features manufacturer's hot process Accelerator for treatment of boiler feedwater, illustrating and explaining its operation and advantages, also optional equipment. Contains excellent discussion of necessity for treatment of makeup water, selection of proper equipment. Also covers the limitations of hot process softening. Infilco Inc.

230 Water Conditioning Data Book — An excellent reference volume, Data Book 2478A contains 108 pp and presents a compilation of 78 chapters and tables. Subjects covered include hydraulics; impurities in water; chemical conversions; coagulant, acid and alkali dosages; chemicals used in water treatment; water treatment processes; boiler feed make-up requirements; alkalinity relationships; specific gravities; chemical reactions. Available to qualified power engineers, please state your job title when requesting this. The Permutit Co.

231 Demineralizers — Valuable information on demineralization is offered power engineers in comprehensive 24-pp Bulletin WC-111. Discusses demineralization in general and its advantages and applications. Basic types of demineralizers and their special uses are charted. Resins, piping, valves and accessory equipment are treated in detail. Book also provides flow charts showing demineralization systems for chemical plants and power plants. Graver Water Conditioning Co.

232 Water Treatment — Bulletin 5000, 24 pp, explains the reasons for boiler water treatment and tells services offered by company in providing formulations for individual plant requirements. Covers pretreatment, internal treatment, treatment application, blow-down adjustment, test control. Dearborn Chemical Co.

FUEL OILS, LUBRICANTS

233 Versatile Industrial Oil — Described in 20-pp Form AD 4078 is an all-purpose oil offering protection for a wide range of industrial equipment, and available in 15 viscosity grades. Discusses six major characteristics of the oil; explains and pictures its use in hydraulic systems, speed reducers, air compressors, electric motors, hydraulic turbines, bearing systems, etc. A chart shows grades available, their uses and physical properties. Standard Oil Co. (Ind.).

234 Turbine Lubrication — The special problems of turbine lubrication are discussed in 8-pp Bulletin TU-1. Tells how purifiers keep power units in service; discusses inhibited and uninhibited oils, company's process for reducing sludge formation within lubrication system. Illustrated with diagrams of typical installations. DeLaval Separator Co.

235 Bearing Lubrication — Vol. XL, No. 10 of this company's Lubrication magazine provides an excellent 12-pp article on industrial bearing lubrication. Illustrated with photos and drawings, text covers such subjects as bearing design; bearing surfaces; bearing overhaul; aspects of lubrication, including factors involved in choice of turbine oils and diesel lubricants, and the deleterious effects of moisture; and the life expectancy of bearing lubricants. The special requirements of porous bearings are also discussed. The Texas Co.

236 Petroleum Pitch — This illustrated article on petroleum pitch as a boiler fuel stresses its low cost, other advantages. Explains combustion of pitch; discusses unloading method, burning, storage, fuel oil treatment, also precautions in handling hot pitch. Kor Corp.

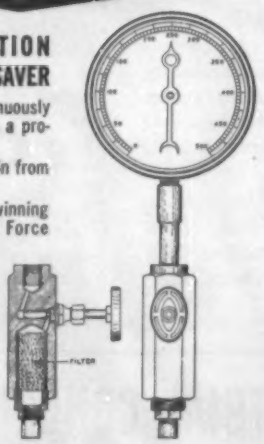
237 Diesels, Their Fuels and Lubricants — This 46-pp book gives practical information on diesel engines, covering their history and economics as well as de-

4 POSITIVE PROOFS OF OUTSTANDING PERFORMANCE

CAMPBELL

MICROBEAN

UNIVERSAL PULSATION DAMPENER & GAUGE SAVER



1. Reports are coming in continuously of its very successful use as a proportioning control valve.
2. Repeat orders are pouring in from all over the world.
3. It played no small part in winning World War II. The Army Air Force bought over 8,000 in 17 repeat orders. They went on every station of the portable pipe lines that followed our conquering armies across North Africa, Sicily, Italy, France and Germany.
4. The U.S. Navy turned it down.

REQUEST LITERATURE

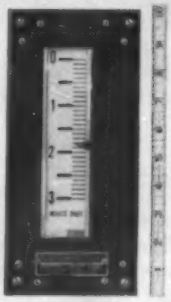
J. A. CAMPBELL CO.

645 E. Wardlow Rd. Long Beach 7, Calif.

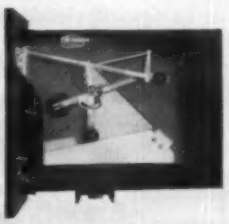
For more data circle 563 on Post Card

They're SPACE SAVERS!

Ellison MINIFIED DIAFRAM ACTUATED STRAIGHT LINE GAGES



- For measuring draft, pressure, differential pressure.
- Unitized mechanism slips out front of case.
- Internally illuminated.
- Standard scale ranges, .6" to 8"—other ranges from 10" to 40".
- Same foolproof mechanism as the larger standard Ellison Draft Gages.
- Non parallax pointers.
- Long service life diafram.



Also MINIFIED Receiver Type Gages for Use With Pneumatic Transmitter.

Send for Bulletin 215

ELLISON DRAFT GAGE CO., INC.

550 W. MONROE ST. Since 1896 CHICAGO 6, ILL.

The Ellison Line Also Includes:

Draft Gages, Bell and Diafram—Inclined Draft Gages—Portable Inclined Vertical Tube Gages—Vertical Tube Gages—Oil, Heavy Liquid and Mercury—Single and Multi-Tube-Saturator Gages—U Gages—Stationary and Portable—Air Filter Gages—Dial and Inclined Tube Types—Pitot Tubes—U Path Steam Calorimeters—Portable Gas Analyzers-Orsat Type

For more data circle 564 on Post Card

sign characteristics and operating principles. Classification of diesels according to speed is covered. A chart shows relation of engine performance to fuel properties. Sinclair Refining Co.

VALVES, TRAPS, PIPING AND ACCESSORIES

238 Check Valves — Twenty-pp Catalog 30 presents company's line of tilting-disc check valves made in iron, bronze and steel for working pressures to 3000 psi. Explains operating principles of tilting disc construction, discusses closing without slam, reduced loss of head, other advantages. Includes construction details, sizes. The Chapman Valve Mfg. Co.

239 Lubricated Plug Valves — Revised Catalog PV-2, 12 pp, presents steel and semi-steel valves designed to offer quick shut-off of erosive or corrosive fluids. Explains advantages of the lubricated tapered plug design of these valves and pictures single gland, screwed gland, and bolted gland types. Also shows accessories. The William Powell Co.

240 Blow-Off Valves — Bulletin B-426, 20 pp, on blow-off valves for boiler pressures up to 400 lb wsp, contains installation recommendations, construction information on Yarway seatless and double-tightening blow-off valves. Gives full ordering data. Yarnall-Waring Co.

241 For Precise Control — Fifty-pp Catalog 17 covers manufacturer's line of disc valves and accessories, providing full selection and ordering data, materials of construction, sizes. Describes manual and automatic controls for these valves which, it is noted, are available in any metal which can be cast or welded. Minimum pressure drop, quick closure, simplicity and other advantages are discussed. R. S. Valve Div., S. Morgan Smith Co.

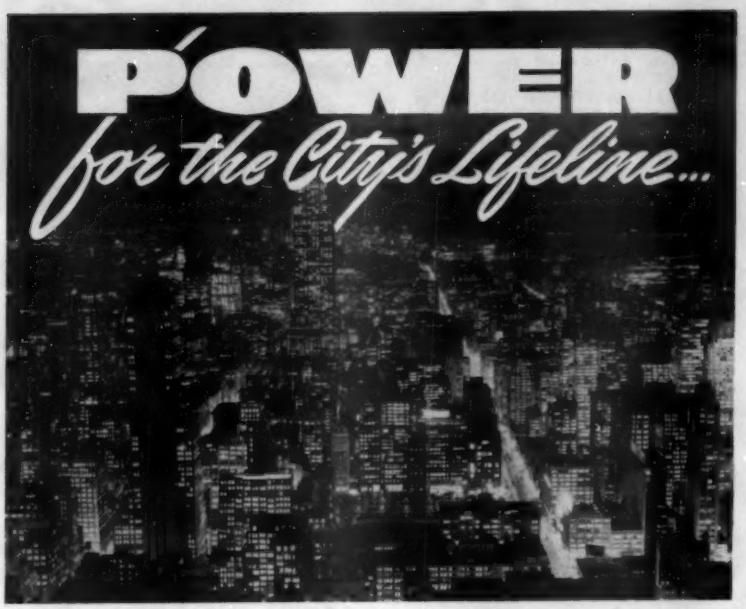
242 Regulating Valves — Bulletin 5305 describes double seated diaphragm regulating valves for use with control instruments, outlining special features of the valves, particularly the "flow line" contoured-body engineered for high capacity at low pressure drop. Leslie Co.

243 Valve Chart — Form 194, 24 pp, is a valve comparison chart, listing valve figure numbers of 15 major manufacturers and the OIC equivalent valve figure numbers. Compares variety of valves in ferrous and non-ferrous materials, describes different valve lines. The Ohio Injector Co.

244 Choosing the Right Valve — Presenting valve selection as a matter of matching the valve's service characteristics with service requirements of the job, this practical 20-pp booklet explains and illustrates basic design features of gate, globe and check valves. It tells, in non-technical language, how each of these valve types works, and where it is suited for use. Disc, stem connection, bonnet and bonnet-joint characteristics are also discussed and the importance of stem operation is treated. Crane Co.

245 Steel Gate Valves — Five types of Hancock general purpose steel gate valves for process and power piping systems are described in illustrated Bulletin 202 B, 12 pp. Material specifications, dimensions given, also service pressure ratings. Manning, Maxwell & Moore, Inc.

246 General Service Valves — Bulletin E-160, 16 pp, describes and illustrates



Protecting the Source of Power is...

MUNDET INSULATION

There's a Mundet Office near you

ATLANTA, GA.
339 Elizabeth St., N.E.
BALTIMORE 30, MD.
100 S. Charles St.
CINCINNATI 2, OHIO
427 West Fourth St.
DALLAS 10, TEXAS
601 Second Ave.
DETROIT 38, MICH.
14401 Prairie Ave.
HOUSTON 11, TEXAS
6601 Supply Row
JACKSONVILLE 2, FLA.
800 East Bay St.
KANSAS CITY 1, MO.
1210 West 9th St.
LOS ANGELES, CAL. (Maywood)
6116 Walker Ave.
NEW ORLEANS 16, LA.
315-325 North Front St.
NEW YORK 17, N. Y.
331 Madison Ave.
PHILADELPHIA 39, PA.
856 North 48th St.
SAN ANTONIO
130 Lombrano St.
ST. LOUIS 9, MO.
3176 Brannon Ave.
SAN FRANCISCO 7, CAL.
440 Brannan St.

In Canada:
Mundet Cork & Insulation Ltd.
35 Booth Ave., Toronto

MUNDET

The lighted city at night is one of the more spectacular examples of power at work for the people. In thousands of other ways less obvious, the nation's power stations supply the power lifeline so essential to our industrial society. A most vital part of the power station's equipment is Mundet Industrial Insulation. The innate thermal insulating efficiency of Mundet insulations is constantly at work serving and protecting power sources.

Mundet's complete line of industrial insulations includes Mundet Tri-Calite Calcium Silicate Heat Insulation for temperatures up to 1200°F, in pipe covering and block forms. This lightweight, low density insulation is economical to ship...easy to handle...and has proved DURABILITY. Coupon brings you full information on Tri-Calite Insulation, with handy Insulation Manual describing other Mundet insulation products.

MUNDET CORK CORPORATION
Insulation Division
7115 Tonnelle Ave., North Bergen, N. J.

Without obligation, send free copy of loose-leaf Mundet Insulation Manual and full information on Mundet Tri-Calite Heat Insulation.

NAME .....

FIRM .....

ADDRESS .....

Mundet Insulation Products include: "Custom-Molded" 85% Magnesia Pipe Covering; Magnesia Blocks and Segmental Covering; High Temperature Pipe Covering and Blocks; "Jointite" Cork Pipe Covering and Corkboard...for all temperature ranges.

For more data circle 565 on Post Card

design and construction of company's quick-operating valves, explaining their application to blow-off service and on chemical process, soot blowers, water column blow-down, and other types of pipe line. Everlasting Valve Co.

247 Industrial Valves — Condensed Catalog 105, 28-pp, contains data on valves for a wide variety of applications. Includes dimensions and illustrations describing non-return (stop-check) valves, globe and angle stop valves, pressure seal design, angle univalves and small size globe valves designed for chain or extension operation in vertical lines. Also included is company's Mudwonder valve for abrasive fluids. Edward Valves, Inc.

248 To Get at Those Valves — This little folder describes a sprocket rim with chain guide. The rim adjusts to fit all valve wheels. Babbitt Steam Specialty Co.

249 Steam Trap Book — Catalog J, 44 pp, serves as a manual of trapping practice. Includes a catalog section giving physical data and prices on cast semi-steel and forged steel inverted bucket steam traps, compound steam traps and ball float air and air relief traps; a handbook section explaining how to calculate condensate loads and select traps for all classes of equipment; a maintenance section explaining trap installation, trouble-shooting and repair. Armstrong Machine Works.

250 Steam Trap Solutions — Bulletin F. 151, 36 pp, is a newly revised edition of this company's well known booklet, "Solving Steam Trap Problems." Organized for easy reference, this illustrated booklet provides specifications and capacities of steam and float traps, air release valves, pipe line strainers. Tells how to calculate condensation loads and select traps for unit heaters, jacketed kettles, submerged surfaces. Gives tips on installing, servicing. The V. D. Anderson Co.

251 Unions and Fittings — Twelve-pp Catalog 50 covers manufacturer's line of unions of all types, elbows, tees and fittings. It describes and illustrates special features. Dart Union Co.

252 Welded Fittings — Catalog 3 is a 36-pp ordering and engineering reference book on company's Weldolets for piping services. Gives data on butt-welding and socket welding Weldolets as well as on Thredolets for making threaded outlets. Typical installations are pictured; sizes, weights and prices provided. Also included are installation instructions and a technical section. Bonney Forge & Tool Works.

When ordering catalogs, allow time for us to relay your requests to the manufacturers—and for them to mail out copies. Remember, manufacturers are often swamped with catalog requests.

253 Improved Pipe Hanger — Twelve-pp Bulletin 153 describes company's Counterpoise pipe hanger for high temperature piping systems in steam generating stations, refineries and chemical plants. Tells how it offers efficient load supporting effort of constant value throughout entire range of travel as pipe expands or contracts. National Valve & Mfg. Co.

254 Stainless Steel Pipe Fittings — Bulletin S-3-55 describes company's 150 lb stainless steel pipe fittings for corrosive, high and low temperature service, including 90 deg elbows, tees, 45 deg elbows, crosses, couplings, reducers, pipe caps, unions, plugs and bushings. Presents dimensional specifications in sizes ⅛ to 2 in. in both screw end and socket welding types. Applications in chemical plants, refrigeration service, food and other process piping given. Watson-Stillman Fittings Div., H. K. Porter Co., Inc.

255 Expansion Joints — Rubber expansion joints for relieving strains and stresses in piping, absorbing vibration, and eliminating noise are the subject of 8-pp Form AD-137. General advantages of rubber expansion joints are presented, and spool-type U-type and rectangular-type joints are described as to construction and intended services. Also provided is catalog sheet on all-Teflon joints and Teflon-lined rubber joints. The Garlock Packing Co.

INSULATION

256 Insulating Material — Ultrafine, a thermal and acoustical insulation made of blown glass fibers, is presented in this bulletin. Shows it in use; gives data on properties, thermal conductivity. Gustin-Bacon Mfg. Co.

257 Pipe Insulation — Mono-Kover, a lightweight one-piece pipe insulation, is described in this bulletin. Photos show how easily it is applied, and text covers its thermal resistance, permanence, resiliency, non-corrosive properties and lower applied cost. Also included are a thermal efficiency chart, insulation thickness selection table, and information on sizes and thicknesses available in this material. Baldwin-Hill Co.

NEW! Re-Designed

Babbitt *Adjustable* SPROCKET RIM *with Chain Guide*

ANY VALVE is readily accessible *from the floor* with low-cost Babbitt Sprocket Rim. Now re-designed for—

- **Greater strength**
- **Easier, quicker, more solid assembly**

Simplifies pipe layouts, prevents accidents, fits all valve wheels. Your supplier carries complete stocks. Call him — or write for folder and prices.

Babbitt STEAM SPECIALTY CO.

4 BABBITT SQUARE, NEW BEDFORD, MASSACHUSETTS, U. S. A.

For more data circle 566 on Post Card

THE CAMBRIDGE

INDUSTRIAL MODEL DIRECT READING

pH METER

- Operated from any AC outlet
- Completely portable. Weighs only 10 lbs. Electrodes are integral parts of the instrument.
- Accurate to .10 pH.
- Shielded glass electrodes permit use of electrodes at any distance from the instrument.
- May be used on a bench or wall mounted.
- Self contained in one metal case including electrodes and buffer solutions.
- Extremely stable.
- Automatic temperature compensation.

Send for bulletin 910-NA

Also available: Electron-Ray Research Model accurate to .02 pH Laboratory Model accurate to .05 pH and Single- and Multi-point recorders.

CAMBRIDGE INSTRUMENT CO., INC.

3767 GRAND CENTRAL TERMINAL NEW YORK 17, N. Y.

Pioneer Manufacturers of

PRECISION INSTRUMENTS

For more data circle 567 on Post Card

258 Data on Insulations — Insulation solutions for a wide range of temperature problems are charted in this folder. Provides brief descriptive information and tells forms available for high temperature applications, for intermediate temperature use, for hot and cold water and low pressure steam, for ice water and frigid temperatures, and other uses. Mundet Cork Corp.

REFRACTORIES

259 Refractory Concrete — Basic information on recommended practice for mixing and placing refractory concrete, used in the metal, power, ceramic, and petroleum refining industry as a material to withstand service temp to 2600 F or more, is presented in this 16-pp manual. Sections are devoted to special properties of refractory concrete, aggregates, refractory insulating concrete, and structural design. Charts and tables afford easy reference. Universal Atlas Cement Co.

260 Refractory Notes — Included in Vol. XV of this company's Thermogram is an illustrated article on a method for degreasing hot topping costs in steel mills with minimum capital expenditure. Another story tells how bonded brick assemblies cut installation time in a coke plant. Refractory & Insulation Corp.

INSTRUMENTS AND CONTROLS

261 Metering and Control Equipment — Sixteen-pp Bulletin 18 is a comprehensive catalog offering information on company's meters, control equipment and engineering services. It is written for engineers in power plants, public utilities and process plants. Fifteen measured variables common to power and process operations form the index for selecting appropriate equipment. Bailey Meter Co.

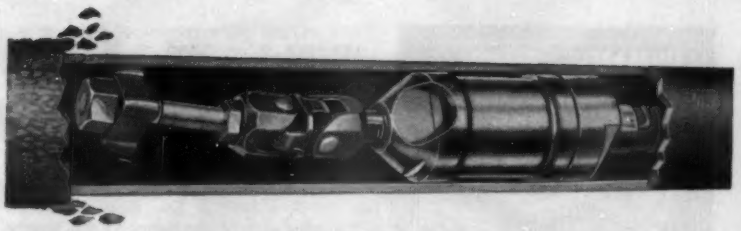
262 Boiler Feed Control — Bulletin 1003, a 12-pp catalog on boiler feed regulators, is illustrated with large application photos and detailed schematic drawings and charts. Relay and direct operation are covered. Case studies of representative boiler loads are presented to show stability of the Flowmatics in controlling feedwater automatically. Copes-Vulcan Div., Continental Foundry & Machine Co.

263 Instruments, Controls — Condensed Catalog 1537 offers brief application information on manufacturer's line of instruments. Fully illustrated, covers draft and pressure instruments, flow meters, liquid levels and pressure gages, CO_2 meters, pneumatic transmitters, positioning operators, temperature instruments, boiler feedwater controls, others. Includes references to detailed literature on each type of equipment. Republic Flow Meters Co.

264 Steam Calorimeter — This bulletin discusses an improved U-path calorimeter combining a throttling, separating and re-evaporating calorimeter in a single chamber. Explains construction and operation of unit. Ellison Draft Gage Co., Inc.

265 For Feedwater Analysis — Bulletin 148BP contains a technical discussion of manufacturer's analyzers for determination of dissolved oxygen and hydrogen in feedwater. Discusses both O_2 and H units as to function, ranges, accuracy. Cambridge Instrument Co., Inc.

266 Sampling System — A newly developed system for continuous sampling



ROTOJET®

Cleans Fire Tubes

FAST

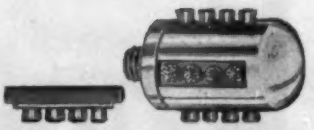
INSIDE and OUTSIDE

You can now clean fire tubes inside as well as outside faster with a new Rotojet. The new Rotojet is the most powerful tube cleaner we ever built. It won't stall at low speeds caused by heavy loads. Roto expanding heads and brushes thoroughly clean soot scale inside tubes. A Roto vibrating head (illustrated above) knocks off water scale adhering on the outside.

Try the new Rotojet, and no other tube cleaner will ever satisfy you.

Economical Roto Brushes

Roto expanding brushes and heads have separately replaceable wearing elements. These inexpensive parts save time, money, and critical materials. Send for details.



Roto expanding brush, showing a replaceable brush element. Brings down tube cleaning cost. Maintains high cleaning efficiency.

Roto solid wire brush.

Model 5525 ROTOJET Air-driven Motor with swing-frame head for 3" O.D. tubes.

Model 5505 ROTOJET Air-driven Motor with 2-arm head for 2" O.D. tubes.

ELLIOTT COMPANY-ROTO DIVISION

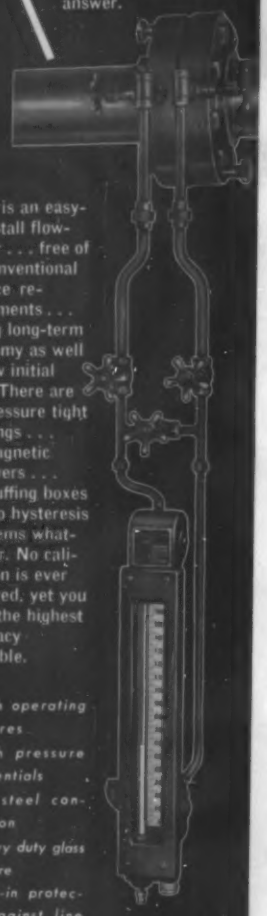
147 Sussex Ave. Newark 1, N. J.

For more data circle 568 on Post Card

UNMATCHED ACCURACY

in direct flow indication

Wherever you seek simplicity and high accuracy in flow measurement at lowest cost, the Meriam "H" Meter is the well-known answer.



Here is an easy-to-install flowmeter . . . free of all conventional service requirements . . . giving long-term economy as well as low initial cost. There are no pressure tight bearings . . . no magnetic followers . . . no stuffing boxes . . . no hysteresis problems whatsoever. No calibration is ever required, yet you have the highest accuracy available.

★ High operating pressures
★ High pressure differentials
★ All steel construction
★ Heavy duty glass enclosure
★ Built-in protection against line surges

Write for Bulletin 18A

Meriam Manometer Instrumentation ...for pressures, vacuums, flows, liquid levels.

meriam

INSTRUMENT COMPANY

10920 Madison Ave. • Cleveland 2, Ohio

For more data circle 569 on Post Card

and oxygen measurement of combustion processes is described in Bulletin 703. Points out advantages of system and diagrams component parts. Selection of sampling tube and gas selector units is discussed. Arnold O. Beckman, Inc.

267 Indicating Flow Meter — Bulletin 18-A, 22-pp, discusses advantages, construction and operation of company's Type H indicating flow meter. Presents technical data on the principles and theory of fluid measurement and discusses orifice type meters and orifice meter principles. Offers examples of flow rate calculations. Schematic drawings and diagrams, tabulated technical data and specifications are included. The Meriam Instrument Co.

268 Easy Reading Gage — An all-hydrostatic remote reading gage for boiler water and other liquid levels is described in Catalog 500, Section CO. Pictures improved visibility, other advantages offered by this gage, explains operation. The Reliance Gauge Column Co.

269 Ideas on Push-Pull Controls — Included in this "Idea File" are answers to a power engineer's questions on the use of push-pull controls. A general information booklet discusses remote control applications, explains construction and operation of company's Tru-Lay controls. Separate bulletins are devoted to standard assemblies, bracket-type head controls, micro controls and hand-operated controls. Automotive and Aircraft Div., American Chain & Cable Co., Inc.

ELECTRICAL EQUIPMENT

270 Motor-Generator Reference Book — Publication 51R7933 is a 50-pp booklet compiled to assist in the selection of motive power to handle most industrial applications. Neither textbook nor ordering catalog, this book provides a brief outline of the various types of motors, generators and motor-generator sets, telling their applications and operating requirements. Booklet is generously illustrated and includes performance data, ratings, information on methods of speed control. Allis-Chalmers Mfg. Co.

271 Electric Motors—Twenty types of company's motors are illustrated in 8-pp Bulletin 1878. Illustrated in natural color, the bulletin contains descriptions of Uni-closed, totally-enclosed, explosion-proof, Varidrive, Syncrogear, combination variable speed and internally geared units, right-angle worm gear, and other types. U. S. Electrical Motors Inc.

272 Motor Buying Guide — Bulletin GEC-1026, 28-pp, features company's standard a-c fractional and integral horsepower motors in most general use. Included are general- and definite-purpose fhp motors, and fhp gear motors. A section on selection of integral horsepower motors covers horsepower requirements, enclosures, starting current limitations, speeds, motor types, and selection of fuses and circuit breakers. Descriptions and specifications include single-phase, polyphase, totally enclosed fan cooled, and gear-type integral horsepower motors. Ratings, book prices, dimensions, frame numbers are included. General Electric Co.

273 Insulation Temperature-Resistance — Technical Publication 21T4, 16 pp, is an article on temperature-resistance characteristics of electrical insulation. Complete with tables and graphs, gives general information on variations in temperature characteristics, composite nature of electrical insulation, and practicability of temperature compensation. Other chapters deal with determining insulation constants for temperature correction factors, and a practical method of obtaining insulation temperature. James G. Biddle Co.

You'll save time in ordering bulletins by using the Reader Service Cards on page 121–122. Of course we honor letterhead requests—but it takes us somewhat longer to handle them.

274 The Answers on Wiring — "20 Questions and 20 Answers on Safety m.i. wiring" describes and illustrates characteristics and advantages of this new wiring system. A complete table of types, sizes, weights and lengths, as well as a partial list of users included. General Cable Corp.

OTHER EQUIPMENT

275 Preheating Combustion Air — This well-illustrated 36-pp booklet explains fuel savings and increased performance made possible by using waste heat in flue gases to preheat incoming combustion air. Also covers increased boiler output, ability to use lower grade fuels, other advantages afforded. Booklet contrasts regenerative with recuperative preheaters; explains operating principle and structural details of the Ljungstrom air preheater.

What's the low-down on blow-down?

The whole story will probably surprise you. It is true, for example, that about 90% of all boiler blow-down today is still hit-or-miss. It's also true that equipment to do the job right can save enough wasted heat units to pay its own way in a matter of months. To get all the eye-opening facts send a card, letter or wire to *The Madden Corp., 1543 W. Morse Ave., Chicago 26, Ill.*, and ask for "Blow-Down Low-down."

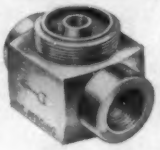
For more data circle 570 on Post Card

NEW-REVOLUTIONARY STEAM TRAP

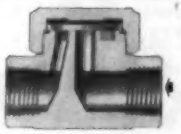
1. A CAP

2. A DISC

3. A BODY



THAT'S ALL!



Only moving part, a hardened Solid Stainless Steel Disc, practically wear-proof!

2134-F

defeats wear-corrosion!

This NEW Sarco Thermodynamic Steam Trap virtually eliminates maintenance. Stainless steel throughout. Only one moving part.

No valve-closing mechanisms to wear or stick. Not affected by superheat, waterhammer, vibration, corrosive condensate. No critical clearances to choke. No gaskets to leak. Same trap for all loads and pressures 10-600 psi.

Write for bulletin 255-44 or a TD trap for a 60-day trial installation. Specify size and application.

SARCO COMPANY, INC.
EMPIRE STATE BLDG., N.Y. 1, N.Y.

For more data circle 571 on Post Card

Sign Your

DECLARATION OF INDEPENDENCE

☆

Buy U. S. Savings Bonds!

THE ALL NEW

CAST-IRON TOTALLY-ENCLOSED MOTOR

TYPE J WITH NEW NEMA RATINGS

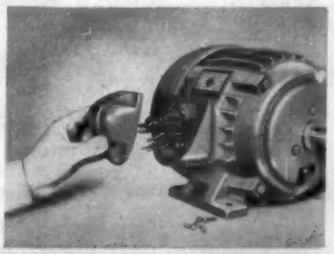
U.S. TOTALLY-ENCLOSED

The frame, end bells, fan guard cover and conduit box of the new Type J (Totally-Enclosed) and Type E (Explosion-Proof) motors are all made of cast iron to offer complete protection against corrosive conditions. The shock-resistant, cast-iron frame is heavily ribbed for added strength and rapid heat dissipation. The iron grille is cast integrally with the fan guard. It permits maximum flow of air to the ventilating fan. prevents entrance of debris, and avoids breakage. These plus many other exclusive U. S. features such as asbestos-protected windings, Lubriflush transverse lubrication, make totally-enclosed motors the most advanced concept of complete protection for dangerous duties.

with

SPLIT DOME CAST-IRON CONDUIT BOX

The conduit box is a heavy duty, cast-iron, diagonally split type, neatly contoured and easiest of access. The box can be rotated to any of four positions.



U. S. MOTORS

Mail coupon for comprehensive fully illustrated booklet

U. S. ELECTRICAL MOTORS INC. PRE-91
Box 2058, Los Angeles 54, Calif. or Milford, Conn.

Please send Bulletin No. 1879

Name_____

Company_____

Address_____

City_____ Zone____ State_____

For more data circle 573 on Post Card

Applications for other than power boilers are also covered in this booklet. Air Preheater Corp.

276 Steam Accumulator—How the steam supply and demand can be balanced by means of company's steam accumulator is told in Bulletin RA-52-8. Stresses reduced boiler capacity required and increased boiler efficiency afforded by use of the accumulator, other advantages. Discusses operating principle, tells how to figure capacity. Foster Wheeler Corp.

277 Dust Collection—Aerodyne dust collectors in chemical processing and other industries are discussed in 8-pp Bulletin 171. Explains theory and design of collector system, includes drawings of the various types covered. The Green Fuel Economizer Co., Inc.

278 Oil and Gas Burners — Bulletion OB-53, 28 pp, gives principles of selection and application of oil or gas burners, or a combination of both for standard and wide capacity range operation, together with air registers and fuel oil heating and pumping sets. Conversion table shows approximate relationships between quantity of oil burned, boiler capacity and air required for combustion. Specifications included. The Engineer Co.

279 Turbine Speed Control—Thirty-pp wire-bound Bulletin H-21 is titled, "Fundamentals of Turbine Speed Control." It is an elaborately illustrated, educational booklet intended to clarify the operation of common types of automatic speed control for steam turbines. An introductory section covers general fundamentals of automatic control systems, and includes a key to control terminology. Simplified diagrams show operating principles of actual control systems. Elliott Co.

280 Packings and Gaskets — Catalog P-100C, 32 pp, covers 95 most popular packings and gaskets in company's line, furnishing details of construction, service recommendations and size information. Includes charts showing specific recommendations for many applications. Packing Div., Raybestos-Manhattan, Inc.

281 Steam Condensers — Some recent additions to this company's power plant condenser installations are pictured and described briefly in this 24-pp booklet. Also included are an engineering section on condenser design factors, and sections devoted to air removal equipment, to steam condenser specialties, and to maintenance services available. Condenser Service & Engineering Co., Inc.

282 For Climate Control — Bulletin 122, 8 pp, introduces an air conditioner designed for precise and economical control of air temperature and moisture. Illustrates design of the new machine, tells its features, and pictures some installations. Tells how it is used in heating and cooling processes. Niagara Blower Co.

283 Fluid Drives — Bulletins 9419 and 9519 are an illustrated catalog and selection guide on company's new Type VS Class 2 Gyrol fluid drives. Catalog discusses advantages and applications of the drives, covering speed control, power savings, simplified installation etc. A sectional view shows construction and principle of operation. Dimensions for six sizes of drives are provided .Selection guide consists of tables indicating proper drive to use with motors from 7.5 to 800 hp. Separate tables cover variable and constant torque loads. American Blower Corp.

284 Technical Refrigeration—Twelve-pp Bulletin 754 covers a complete line of environmental testing and processing equipment. Provides illustrations and specifications on recently redesigned altitude, humidity, low temperature and prefabricated test chambers as well as specialized testing equipment. Includes helpful engineering data. Bowser, Inc.

285 Refrigerator Condensers—Bulletin RC-2, 38 pp, utilizes drawings, tables and engineering data to show how to select proper type from company's line of ammonia and Freon condensers for refrigeration services. Illustrates horizontal multipass shell and tube types; vertical singlepass shell and tube types. Gives pipe sizes for ammonia and Freon lines; also includes information on stands for condensers. Henry Vogt Machine Co.

286 Water Heaters — Illustrated 6-pp Bulletin 70, Section I, on instantaneous type water heaters contains detailed capacity and dimension tables for two-, four- and six-pass designs, removable tube bundles. Davis Engineering Corp.

287 For Burning Refuse Fuel — This 8-pp bulletin describes refuse fuel burning equipment, including a pneumatic refuse fuel distributor which spreads refuse fuels such as bark, wood chips, and bagasse uniformly over the grate surface. Discusses construction features of various components, the selection of grates, as well as pertinent design and engineering features. Riley Stoker Corp.

Nagle®
PUMPS
HANDLE 600 GPM
FLY ASH SLURRY IN
MODERN POWER PLANT

Two Nagle 4" type "T" pumps, in a two stage installation, are ably handling 600 GPM of fly ash slurry against 400 ft. of head, at Windsor plant of Beech Bottom Power Co., Power, W. Va. Water-end parts are of abrasion resistant ABK Ni-Hard nickel iron alloy.

Design of the Nagle type "T" pump provides quick slippage seal adjustment, accessibility of stuffing box and split bearing stand. Entire pump can be quickly dismantled, but it's seldom necessary because it's a Nagle Pump—built for gritty, abusive jobs—pumping abrasive and corrosive materials or hot liquids.

SEND FOR CATALOG 5206

NAGLE PUMPS, INC.
1229 CENTER AVE., CHICAGO HEIGHTS, ILL.

NAGLE PUMPS

PUMPS FOR ABRASIVE AND CORROSIVE APPLICATIONS

For more data circle 574 on Post Card

ERNST
SIGHT FLOW INDICATORS
"See What Goes On Inside"

For insertion into pipe
FOR EVERY APPLICATION
BRONZE, IRON, STEEL, STAINLESS STEEL

FIG. 29
Cylinder with Impeller

FIG. 17-28
Cylinder

FIG. 215
Flanged

FIG. E-57
Double Window

FIG. 212
Visibility Welding Neck or Screw

FIG. E-811
Flapper

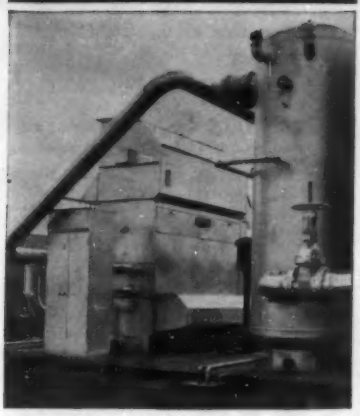
FIG. E-1810
Rotating Wheel Type

All sizes up to 6" Send for Catalog

ERNST WATER COLUMN & GAGE CO.
LIVINGSTON, N. J.

For more data circle 575 on Post Card

HOW YOU SAVE . . .



. . . getting drier Compressed Air

● Save the cost of cooling water and you save the price of the Niagara Aero After Cooler (for compressed air or gas) in less than two years.

Extra, for no cost, you get drier compressed gas or air for your process. You get better operation and lower costs in the use of all air-operated instruments, machines, or paint sprays. You save expense for piping, pumping, water treatment and disposal. You get the use of badly needed water elsewhere in your plant.

Niagara Aero After Cooler cools compressed air or gas (evaporatively) below the temperature of surrounding atmosphere, with no further condensation in your air lines.

Write for complete information; ask for Bulletin No. 98, or contact nearest Niagara Engineer if you have any problem involving the industrial use of air. Address Dept. E.

NIAGARA BLOWER COMPANY
405 Lexington Ave., New York 17, N.Y.
District Engineers in Principal Cities of U. S. and Canada

For more data circle 576 on Post Card

Equipment News

Continued from page 52

31—QUICK-OPENING DOOR for use on pressure vessels

The Lever-Lock Door is self-seating and designed to reduce the time needed to open heat exchangers, autoclaves, sterilizers and other pressure vessels. Locked and unlocked by bars, the Lever-Lock Door is claimed to take about 5 sec to open. According to manufacturer, this door is particularly well suited for use on heat exchangers that carry high-fouling liquids and require frequent entry for inspection. It is declared capable of withstanding temperatures from −70 to 400 F, and pressures from vacuum to 300 psi.

The bars on the Lever-Lock Door are inserted withdrawn by a hand operated lever at the center of the door; this lever opens with a turn of 60 deg and about a 15 lb pull. The door can be swung open manually or by means of a pneumatic cylinder. A mechanical lock safety device is incorporated to keep the door closed while the vessel is under pressure. The door may be used vertically or horizontally — in vertical operation a pneumatic lifting mechanism is required. The Patterson-Kelley Co., Inc.

32—METERING PUMP is solenoid-clutch operated

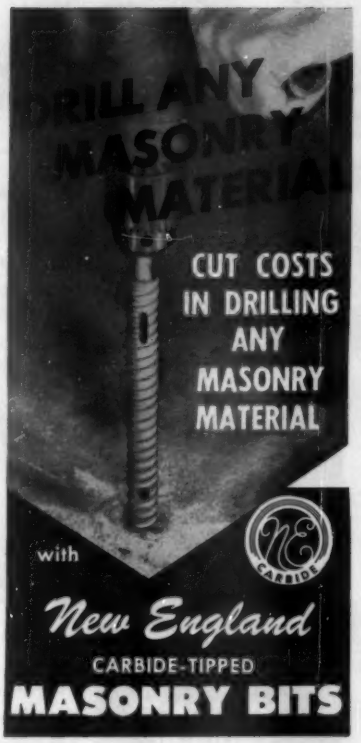
For metering to a flow, UMC Pump is a positive displacement unit actuated by a solenoid operated single revolution clutch. This arrangement permits one stroke of the pump plunger in response to an electric signal which may be timed to effect a feed rate to the main flow line at regularly timed intervals, it is explained. Electrical impulses can originate from a mechanical flow meter, differential meter, gravimetric meter, or program timer.

Though designed primarily for metering and proportioning of additives and odorants to fuel and natural gas lines, this pump is also suggested for the addition of boiler feed compounds and use in chemical and food processing. Its outstanding features are announced as low unit and operating cost, positive operation and immediate availability. The UMC Pump comes in maximum capacities from 0.10 gph to 20 gph per feed. Single feed is standard, but two-feed units are available — operating pressures to 5000 psi. Hills-McCanna Co.

33—MULTIPLE OUTLET HEADER affords easier installation

Reported to effect 70 per cent saving in welding time required to complete bypass, blow-down and branch connections to pipeline gate settings, this fitting consists of a header with multiple seamless outlets in exact specified positions . . . plus a factory-fabricated conical reducer. The fitting is designed to eliminate nozzling in branch connections and saddle reinforcements.

According to manufacturer, the design and metallurgical integrity of these headers provides not only strength superior to that of the piping to which it will be joined, but also additional resistance to stresses from thermal difference and external mechanical loads, plus maximum resistance to shock and vibration loads. Basic design of the headers paral-



ROTARY TYPE *Cyclo-twist and Cyclo-Core*

HAMMER TYPE *Thunder-twist and Thunder-Core*

The ONLY Complete Line of Carbide-Tipped Masonry Bits in the world.

- Bits . . . to drill any kind of masonry, soft, medium, hard or abrasive.
- Bits . . . to drill any size of hole from 1/8" to 6".
- Bits . . . to drill any depth of hole up to 36"
- Bits . . . rotary electric drills or power hammer.
- Bits . . . that do the job easier, quicker and more economically.

Send for your FREE "What and How" Manual of Masonry Drilling. Shows you the right bit for any masonry.

NEW ENGLAND CARBIDE TOOL CO., INC.
60 Brookline St., Cambridge 39, Mass.

Please send me my FREE "What and How" Manual.

NAME _____

COMPANY _____

STREET _____

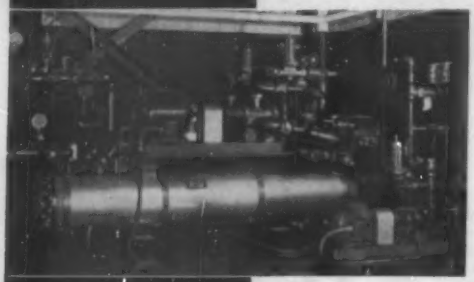
CITY _____ STATE _____

For more data circle 577 on Post Card

ENCO
Fuel Oil Pumping and Heating Systems

For heavy bunker oil or light furnace oil...100 to 10,000 gallons per hour

Enco systems employ one, two or more pumps and heaters, interconnected so that full capacity is possible with any combination of pumps and heaters. Flexibility of design permits the use of any combination of rotary pumps, with motor or turbine drive; or piston type steam pumps. Any part may be cut out of operation for inspection or cleaning, without shutting down, where two or more pumps and heaters are included in the unit system.



Heaters are insulated and jacketed with removable heads at both ends for cleaning without breaking any piping connections or removing any tube bundles.

Full automatic oil pressure and temperature control, with relief valves for each pump and heater. Permits delivery of oil with safety, and at proper temperature and pressure for efficient burning.

Each unit is built to order and delivered ready to place on foundation and for connection to the station piping.

Write for Bulletin OB-53 describing Enco Gas and Oil Burners; and Pumping and Heating Equipment.

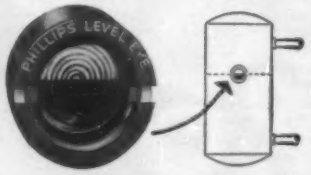
THE ENGINEER COMPANY
75 WEST STREET
NEW YORK 6, N. Y.

EC 808

For more data circle 578 on Post Card

For more data circle 579 on Post Card

PHILLIPS
Level Eye



lets you "see" level of liquids in pressure systems

- ★ Low cost, simple to install
- ★ for temperatures from —50° to 250° F.
- ★ rupture strength 7500 psi
- ★ for use with water, oil and all refrigerants
- ★ Lens won't frost over
- ★ Available on column or for welding into your equipment
- ★ Standard on Phillips Float Controls

WRITE FOR "LEVEL EYE" BULLETIN

H. A. PHILLIPS & CO.
Designers and Engineers
Refrigeration
Control Systems
3255 W. Carroll Ave.
Chicago 24, Illinois

PHILLIPS

For more data circle 580 on Post Card

lels integral outlet of seamless welding tees. They can be produced in sizes through 42-in. pipe and larger, virtually without restriction as to length of header section, number, size or arrangement of outlets or range of conical reducer sizes. In addition to being used for valve settings on the main line, these headers are also suited as suction and discharge manifolds on compressors. Ladish Co.

34—CONTACT BURNISHER for relays, solenoids, brushes

The handy, pocket-sized Contact Burnisher No. 160 can be kept available for ready use. Fitted in a pen-type case, the burnishing element, a micro-fine surface gives mild abrasive action. The abrasive, while it removes dust, grit and carbon build-up, removes only a minimum of contact metal, says manufacturer. Tests are reported to show that frequency of contact maintenance can be decreased because of the polishing action of this burnisher — it leaves no oil film, grit, dirt or contact filings. The element is protected by its case, and being of insulating plastic, this case is also said to permit burnisher's use on energized contacts. Adre Co.

Reader Service Cards on pages 121–122 make it easy to get further information on any of these products. Just circle the item numbers of the products you want to know more about.

35—BUTTERFLY VALVE, of stress sealed design

Developed to meet rigorous tolerance of permissible leakage in the closed position under high pressure and high temperature conditions, this stress sealed butterfly valve is 36-in. pipe size, of mild steel, with 125 lb American Standard flanges. The steel disc has a stainless steel seating edge. When rotated to the closed position, this disc seats against an Inconel-X band in the valve body. This band is then inflated under nitrogen pressure for essentially tight shut-off at operating temperatures to 800 F. Manufacturer says the valve has been tested to a leakage not exceeding 0.005 lb of air per second, with a 10 lb differential across the disc.

Said to be a major factor in minimizing or eliminating leakage is the off-set shaft design, which permits 360-deg sealing surface of the disc without necessity of the shaft going through the stress seal band. The valve is operated by a hydromotor driven by oil at 300 psi. Limit switches indicate full open and closed positions. W. S. Rockwell Co.

36—CONDENSATION UNITS with larger size tanks

Type HR Apco-Matic Condensation Return Units, equipped with larger receiver tanks for use where additional condensate storage is desired, are designed for use with heating systems having ratings from 800 to 10,000 E.D.R. and pressures to 80 psi. Units come in both simplex (single pump) and duplex (twin pump) models; the latter are designed to return

CLASSIFIED ADVERTISING

LOW TEMPERATURE ENGINEERING

Opportunities for

MECHANICAL *and* CHEMICAL ENGINEERS

Interesting projects involving thermodynamics, heat transfer, fluid flow, distillation, vacuum technique, equipment design, instrumentation and controls, process engineering, pilot plant design and operation.

Research, as well as practical design and development engineering. Projects associated with production and distribution of oxygen, nitrogen and argon as low temperature liquids or as gases.

- No training school or drawing board apprenticeship.
- Bachelors, Masters or Ph.D. graduates.
- Send résumé of educational background (please include approximate academic standing), and work experience to:

LINDE AIR PRODUCTS COMPANY

a division of

UNION CARBIDE AND CARBON CORPORATION

P. O. Box 44 **Tonawanda, New York**

Attention: MR. PAUL I. EMCH

FOR SALE THREE COAL PULVERIZERS

These three Babcock and Wilcox type E-56, Class 111-BA coal pulverizers were bought new, have never been used, and are in good condition. They are complete with their primary air fans, motors, controllers, and other auxiliary apparatus. For detailed information write Purchasing Department, P.O. Box 570, Savannah, Ga.

FOR SALE

One Marley 8000 K W Capacity Dual Unit Cooling Tower

Formerly used by Hinsdale Municipal Power Plant, now sold and discontinued. Equipped with dual reversible fans. The tower is of red wood, 4 years old and in excellent condition. Buyer to dismantle and remove entire structure including above ground piping. Any reasonable offer considered. Can be seen at Hinsdale, Ill. Send proposals to T. M. WARDWELL, *Village Manager*, Hinsdale, Illinois.

WANTED

Electrical Engineering Draftsman capable of general plant layout work and design for automatic control in connection with plant mechanization. Give experience and salary range with application. Location South. Box 1701, POWER ENGINEERING, 110 S. Dearborn St., Chicago 3, Illinois.

THE LUMMUS COMPANY

Engineers and Constructors

385 Madison Avenue, New York, N. Y.

Chicago — Houston — London — Paris — The Hague — Montreal — Caracas — Bombay

J. E. SIRRINE COMPANY

Engineers

Design and Supervision of Steam and Hydro-electric Power Plants, Industrial Plants, Mechanical and Operating Surveys, Appraisals • Plans • Reports

Greenville, South Carolina

condensate to two boilers or, when connected to a single boiler, to provide built-in standby facilities. Both models are automatic in operation. The vertical turbine type pump design provides quiet operation and dependable performance, it is pointed out, and the pumping unit is bronze for resistance to corrosion.

Receiver is cast iron, with extra heavy walls. Despite its 25-gal capacity, the return opening of this tank is only 16 in. from floor, permitting easy connection to low return lines. Duplex models can be furnished with a mechanical alternator which normally operates pumps alternately. Aurora Pump Div., New York Air Brake Co.

37—TUBEAXIAL FANS for the difficult air moving jobs

Belt-driven tubeaxial propeller fans designed for handling corrosive exhaust, high temperature, explosive fumes and similar applications are available in five sizes from 16 through 36 in., with air delivery ratings to 26,000 cfm. In this line of fans, the Type BT, the fan drum is rolled from 12-gage steel plate. Integrally rolled mounting flanges and continuous welded seams are utilized to eliminate fume or condensate leakage and subsequent corrosion.

Other design advantages of the fans include the motor-mount assembly which permits 3-in. belt adjustment and is drilled to accommodate any motor from ¼ to 5 hp, 1725 rpm to facilitate motor changes; propellers cast from an aluminum-magnesium alloy said to provide high tensile strength and dimensional stability, and to have greater corrosion resistance to mild alkalies than many propeller metals; and a one-piece cast-iron housing which isolates fan bearings from the polluted air stream. The fans are powered by company's All-Weather Motors. Propellair Div., Robbins & Myers, Inc.

38—STORAGE RACKS hold conduit, piping vertically

Storage of large quantities of electrical conduit and other piping material is possible in less space with these vertical conduit racks. Lengths of conduit up to 10 ft can be stored upright, says manufacturer, and withdrawing of materials is made easier by the vertical position. The racks are individual units, require neither fastening to floor nor bracing to walls or ceiling. Being anchored by their own weight, they become more stable as the load is increased, it is noted. Each rack provides 9 sq ft of conduit storage space. The racks may be placed singly, in rows or back to back. To expedite shipping and receiving of conduit, racks may be bolted to a pallet and transported by industrial truck. Made of steel, racks are 36 by 48 in., 8 ft high. The Frick-Gallagher Mfg. Co.

39—HEAVY-DUTY RELAYS require minimum panel space

A line of 10-amp control relays, designed to occupy minimum panel space without sacrificing ruggedness, is said to afford easier wiring and maintenance. The line, the Type PM, includes 2- to 12-pole relays. They feature a sectional pole design in which each pole is mounted in its own melamine block. Poles are individually removable and replaceable. Clark Controller Co.

Tells how to use pH, chlorine, and phosphate control to reduce corrosion, scale, slime, sludge in heating and cooling systems.

100 pages of factual data on theory and application of pH, chlorine, phosphate, nitrate control and complete boiler water analysis. Useful every day. Clearly written, concise, easy-to-read. Data based on 25 years service to industry. Also illustrates and describes complete line of Taylor Comparators, tells how to use Taylor sets in your plant.

WRITE FOR YOUR FREE COPY TODAY!

SERVING SCIENCE AND INDUSTRY 1930/1955 FOR 25 YEARS

W. A. TAYLOR AND CO.
410 ROGERS FORGE RD. • BALTIMORE 4, MD.

For more data circle 581 on Post Card

ADVERTISERS' INDEX

AIR PREHEATER CORP., INC. 109
Agency—G. M. Basford Company
AIRETOOL MFG. CO. ..... *
Agency—Harry M. Miller, Inc.
ALLIS-CHALMERS MFG. CO. 7, 45
Agency—Compton Advertising, Inc.
ALLIS-CHALMERS MFG. CO. (TRACTOR DIV.) 103
Agency—Bert S. Gittins Advertising
AMERICAN BLOWER CORP. 40–41
Agency—Brooke, Smith, French & Dorrance, Inc.
AMERICAN CHAIN & CABLE CO., INC. 48
Agency—Reincke, Meyer & Finn, Inc.
AMERICAN CHIMNEY CORP. 134

AMERICAN ENGINEERING CO. ..... *
Agency—Beatty and Oliver, Inc.
AMERICAN PULVERIZER CO. ..... *
Agency—Batz-Hodgson-Neuwoetner
V. D. ANDERSON CO. ..... *
Agency—Will, Inc.
ARMSTRONG MACHINE WORKS 2
Agency—Russell T. Gray, Inc.

BABBITT STEAM SPECIALTY CO. 128
Agency—George T. Metcalf Co.
BABCOCK & WILCOX CO., THE 53
Agency—O. S. Tyson and Co., Inc.
BABCOCK & WILCOX CO. (TUBULAR PRODUCTS DIV.) ..... *
Agency—O. S. Tyson and Co., Inc.
BAILEY METER COMPANY 36
Agency—Fuller & Smith & Ross, Inc.
BALDWIN-HILL CO. 35
Agency—Eldridge, Inc.
BALTIMORE & OHIO RR. 113
Agency—Richard A. Foley, Inc.
BECKMAN, ARNOLD O., INC. 116
Agency—Dozier Eastman & Co.
BELMONT PACKING & RUBBER CO., THE 106
Agency—Roa, Fuller & Co., Inc.
BETZ, W. H. & L. D. ..... *
Agency—The Michener Co.
BIDDLE CO., JAMES G. ..... *
Agency—The Roland G. E. Ullman Organization, Inc.
BIRD-ARCHER CO., THE ..... *
Agency—The Roland G. E. Ullman Org.
BITUMINOUS COAL INSTITUTE 51
Agency—Vansant, Dugdale & Co., Inc.
BOILER ENGINEERING & SUPPLY CO. 34
Agency—John B. Ferguson Jr.
BOWSER, INC. 110
Agency—Willis S. Martin Co.
WM. BROS BOILER & MFG. CO. 30
Agency—The Alfred Colle Co.
BURGESS-MANNING CO. ..... *
Agency—Merchandising Advertisers, Inc.
BUSSMANN MFG. CO. ..... *

BYRON-JACKSON CO.—PUMP DIV. 117
Agency—Ramsey, Barley & Brown

C & D BATTERIES ..... *
Agency—John T. Hall & Co.
CAMBRIDGE INSTRUMENT CO., INC. 128
Agency—E. M. Freystadt Associates, Inc.
J. A. CAMPBELL CO. 126
Agency—The McCarty Co.
CHAPMAN VALVE MFG. CO., THE ..... Inside Back Cover
Agency—Sutherland-Abbott
CHESAPEAKE & OHIO RAILROAD 105
Agency—Robert Conahay, Inc.
CHICAGO EXPOSITION OF POWER & MECHANICAL ENGINEERING 12–13
Agency—O. S. Tyson & Co., Inc.
CLEAVER BROOKS CO. (BOILER DIV.) 21
Agency—Klau-Van Pietersom-Dunlap, Inc.
COCHRANE CORPORATION 97
Agency—Hening & Co., Inc.
COMBUSTION ENGINEERING, INC. 10–11
Agency—G. M. Basford Company
CONDENSER SERVICE AND ENGINEERING 108
Agency—Joseph S. Vogel & Co.
CRANE CO. 43
Agency—The Buchen Company
CRANE PACKING CO. 22
Agency—Symonds, MacKenzie & Co., Inc.

DART UNION CO. ..... *
Agency—Sutherland-Abbott
DAVIS ENGINEERING CORPORATION 118
Agency—Thomas & Delehanty, Inc.
DEARBORN CHEMICAL CO. 38–39
Agency—The Buchen Co.
DE LAVAL SEPARATOR CO., THE ..... *
Agency—Donahue & Co., Inc.
DE LAVAL STEAM TURBINE CO. 101
Agency—Michel-Cather, Inc.
DETROIT STOKER COMPANY 14–15
Agency—Witte & Burden

DOWELL INCORPORATED ..... *
Agency—MacManus, John & Adams, Inc.

EDWARD VALVES, INC. 22–23
Agency—Marsteller, Rickard, Gebhardt & Reed, Inc.
ELLIOTT CO. ..... Inside Front Cover
Agency—Peterson & Kempner, Inc.
ELLISON DRAFT GAGE CO. 126
Agency—Tri-State Advertising Co., Inc.
ENGINEER CO., THE 134
Agency—Michel-Cather, Inc.
ERIE CITY IRON WORKS ..... *
Agency—Davies and McKinney
ERNST WATER COLUMN & GAGE CO. 132
Agency—Lasky Co.
EVERLASTING VALVE CO. 104
Agency—Michel-Cather, Inc.

FOSTER WHEELER CORP. 24–25
Agency—Marsteller, Rickard, Gebhardt & Reed, Inc.

GARLOCK PACKING CO., THE 137
Agency—Hutchins Advertising Company, Inc.
GENERAL CABLE CORP. ..... *
Agency—Hicks & Greist, Inc.
GENERAL ELECTRIC CO. ..... *
Agency—G. M. Basford Co.
GOODALL RUBBER CO. ..... *
Agency—George C. Taylor Advertising
GRAVER WATER CONDITIONING CO. 138
Agency—Trade Method Advertising
GREEN FUEL ECONOMIZER CO. 49
Agency—Sanger-Funnell, Inc.
GUSTIN-BACON MFG. CO. 29
Agency—Valentine-Radford Advertising

HAGAN CORPORATION 54–55
Agency—Ketchum, MacLeod & Grove, Inc.
HALL LABORATORIES, INC. ..... *
Agency—Ketchum, MacLeod & Grove, Inc.
HAYS CORPORATION, THE ..... *
Agency—Proebsting, Taylor, Inc.
HENSZEY COMPANY ..... *
Agency—Keck Advertising Agency
HILLIARD CORP., THE ..... *
Agency—Mellor Advertising Agency, Inc.
HUYETTE CO., INC., PAUL S. 134

ILLINOIS WATER TREATMENT CO. ..... *
Agency—Cummings, Brand & McPherson
INFILCO INC. ..... *
Agency—Willard G. Gregory & Co.
INSTROF, INC. ..... *
Agency—R. E. Lovekin Corp.
INTERNATIONAL NICKEL COMPANY, INC., THE ..... *
Agency—Marschalk & Pratt Co. Division of McCann-Erickson, Inc.

JOHNS-MANVILLE ..... *
Agency—J. Walter Thompson Company
JOHNSON-MARCH CORP. ..... *
Agency—Beaumont, Heller & Sperling, Inc.

KIRK & BLUM MFG. CO. ..... *
Agency—The S. C. Baer Co.
KOR CORPORATION 124

LADISH CO. ..... *
Agency—The Cramer-Krasselt Co.
LEFAX ..... *
Agency—H. Lesseraux
LESLIE CO. 107
Agency—Macready, Reid, Handy & Van Denburgh

MADDEN CORP., THE 130
Agency—Kreicker & Meloan, Inc.
MANNING, MAXWELL & MOORE, INC. 20, 115
Agency—Fuller & Smith & Ross, Inc.
MERIAM INSTRUMENT CO., THE 130
Agency—Thomas R. Sundheim
MILTON ROY CO. 47
Agency—The Aitken-Kynett Co.
MUNDET CORK CORP., INSULATION DIV. 127
Agency—J. C. Bull, Inc.

NAGLE PUMPS, INC. 132
Agency—Tri-State Advertising Co., Inc.
NATIONAL AIROIL BURNER COMPANY, INC. ..... *
Agency—R. E. Lovekin Corp.
NATIONAL ALUMINATE CORPORATION ..... *
Agency—Armstrong Advertising Agency
NATIONAL VALVE & MFG. CO. 33
Agency—Band & Starr, Inc.
NEW ENGLAND CARBIDE TOOL CO. 133
Agency—Callaway Associates

NIAGARA BLOWER COMPANY 133
Agency—The Moss-Chase Company

OHIO INJECTOR CO. ..... *
Agency—Fuller & Smith & Ross, Inc.
ORR & SEMBOWER, INC. ..... *
Agency—Beaumont, Heller & Sperling, Inc.

PEABODY ENGR. CORP. ..... *
Agency—Richard La Fond Adv. Inc.
PEERLESS PUMPS DIV. FOOD MACHINERY & CHEMICAL CORP. ..... *
Agency—The McCarty Co.
PERMUTIT CO., THE ..... Back Cover
Agency—Cunningham & Walsh, Inc.
H. A. PHILIPS 134
Agency—Glenn-Jordan-Stoetzel Inc.
PITTSBURGH PIPING & EQUIPMENT CO. ..... *
Agency—W. S. Hill Co.
POWELL VALVES 26
Agency—The Ralph H. Jones Co.
PREFERRED UTILITIES MFG. CORP. ..... *
Agency—Spooner & Kriegel

QUAKER RUBBER CORP. DIVISION OF H. K. PORTER CO., INC. OF PITTSBURGH ..... *
Agency—Fox & MacKenzie Advertising

RANNEY METHOD WATER SUPPLIES, INC. ..... *
Agency—Cye Landy Advertising Agency, Inc.
RAYBESTOS-MANHATTAN, INC. 119
Agency—Gray & Rogers
REFRACTORY & INSULATION CORP. 114
Agency—Spooner & Kriegel
RELIANCE GAUGE COLUMN COMPANY 52
Agency—Carr Liggett Advertising, Inc.
REPUBLIC FLOW METERS CO. 16–17
Agency—Glenn, Jordan, Stoetzel, Inc.
REVERE COPPER AND BRASS, INC. ..... *
Agency—St. Georges & Keyes, Inc.
RIC-WIL INC. ..... *
Agency—Ritchie & Sattler, Inc.
RILEY STOKER CORPORATION 18–19
Agency—The Davis Press, Inc.
ROTO DIV. OF ELLIOTT CO. 129
Agency—Jos. S. Vogel & Co.
R-P & C VALVE DIVISION, AMERICAN CHAIN & CABLE CO., INC. 48
Agency—Reincke, Meyer & Finn, Inc.

SANTA FE TANK & TOWER CO. ..... *
Agency—Advertisers Production Agency
SARCO COMPANY, INC. 131
Agency—Marsteller, Richard, Gebhart & Reed, Inc.
SCHUTTE & KOERTING CO. 37
Agency—Harris D. McKinney, Inc.
SCOVIL MFG. CO. 123
Agency—Robotham & Peck, Inc.
SINCLAIR REFINING CO. 5
Agency—Morey, Humm & Johnstone, Inc.
SMITH CO., S. MORGAN ..... *
Agency—Fuller & Smith & Ross, Inc.
SOUTHERN COAL CO., INC. ..... *
Agency—Hitchcock & Becker Advertising
SPRINGFIELD BOILER CO. ..... *
Agency—Armstrong Advertising Agency
STANDARD OIL CO. (INDIANA) ..... *
Agency—D'Arcy Advertising Co.
STEPHENS-ADAMSON MFG. CO. ..... *
Agency—Glenn-Jordan-Stoetzel, Inc.
STONE & WEBSTER ENGINEERING CORP. ..... *
Agency—Harold Cabot & Co., Inc.
SUPERIOR COMBUSTION INDUSTRIES, INC. 120
Agency—Charles H. Davis

TAYLOR & CO., W. A. 135
Agency—Emery Advertising Corporation
THE TERRY STEAM TURBINE CO. ..... *
Agency—Gassaway Advertising Agency
TEXAS CO., THE ..... *
Agency—Erwin, Wasey & Company, Inc.

UNION ASBESTOS & RUBBER CO. 111
Agency—The Buchen Co.
U. S. ELECTRICAL MOTORS, INC. 131
Agency—The McCarty Co.
UNIVERSAL ATLAS CEMENT CO. 125
Agency—Batten, Barton, Durstine & Osborn, Inc.

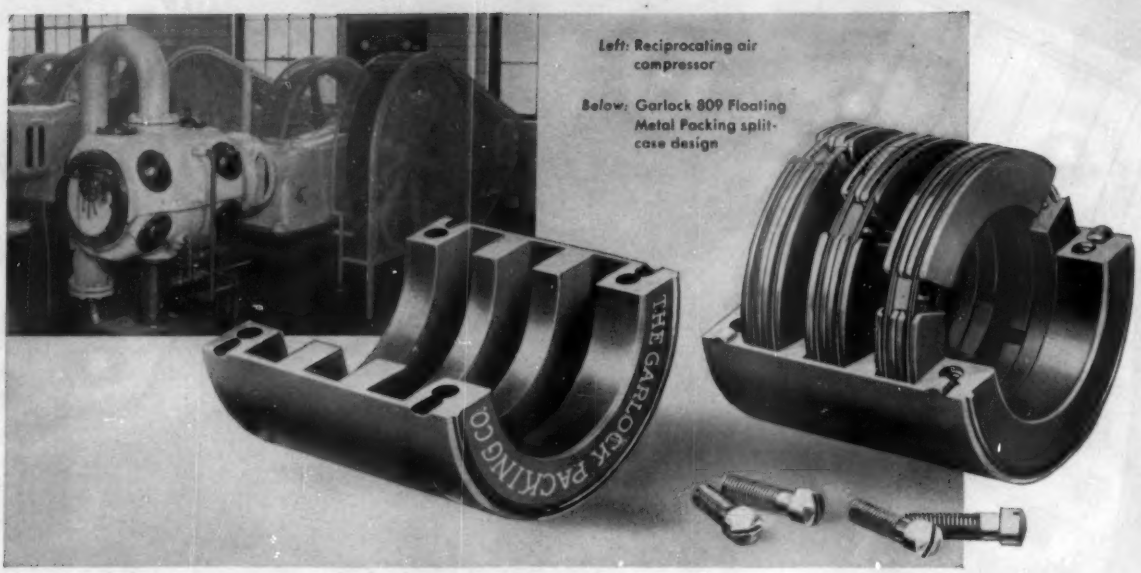
VAN DER HORST CORP. ..... *

VOGT MACHINE CO., HENRY 99
Agency—Farson, Huff & Northlich

WALLACE & TIERNAN PRODUCTS, INC. 112
Agency—Branstate Associates, Inc.
WATSON-STILLMAN CO. 30
Agency—W. L. Towne Advertising
WESTERN CHEMICAL COMPANY ..... *
Agency—Carter Advertising Agency, Inc.
WESTERN PRECIPITATION CORP. ..... *
Agency—Dozier, Eastman & Co.
WILSON, INC., THOMAS C. ..... *
Agency—Michel-Cather, Inc.
WORTHINGTON CORPORATION 31
Agency—James Thomas Chirurg Company

YARNALL-WARING COMPANY 8–9, 56
Agency—The Michener Co.

Firms whose advertising is not in this issue but is appearing in other issues is marked with an *



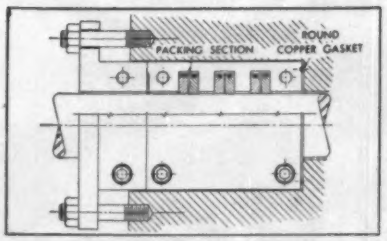
Left: Reciprocating air compressor

Below: Garlock 809 Floating Metal Packing split-case design

For air compressors, users report

GARLOCK SPLIT-CASE METAL PACKINGS

have 2 big advantages



TYPICAL SERVICE REPORTS

- On an electric-driven compressor, rod size 1¾", 277 r.p.m., operating continuously, Garlock metal packing has been in service 9 years with the original cast iron rings and only .002" rod wear.
- On steam-driven, variable-speed compressors in a power plant, Garlock split-case metal packings have operated satisfactorily for 15 years without replacement of any parts.

1. **LONG, TROUBLE-FREE LIFE.** Minimum of 7 years with proper lubrication.

2. **CAN BE INSTALLED *WITHOUT* DISCONNECTING THE ROD.** Downtime is reduced to a minimum.

You can eliminate the cost of frequent packing replacements and unnecessary downtime by installing Garlock split-case metal packings on your reciprocating air compressors. Service reports like those at the left, show that these Garlock metal packings have given 15 years *and more* of trouble-free service with a minimum of rod wear.

The minimum packing space for Garlock 809 split-case metal packing is ½". Garlock 805 (also split-case) can be used in smaller packing spaces since it is installed outside the stuffing box.

For complete information, call your Garlock representative or write today for Brochure 3889.

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

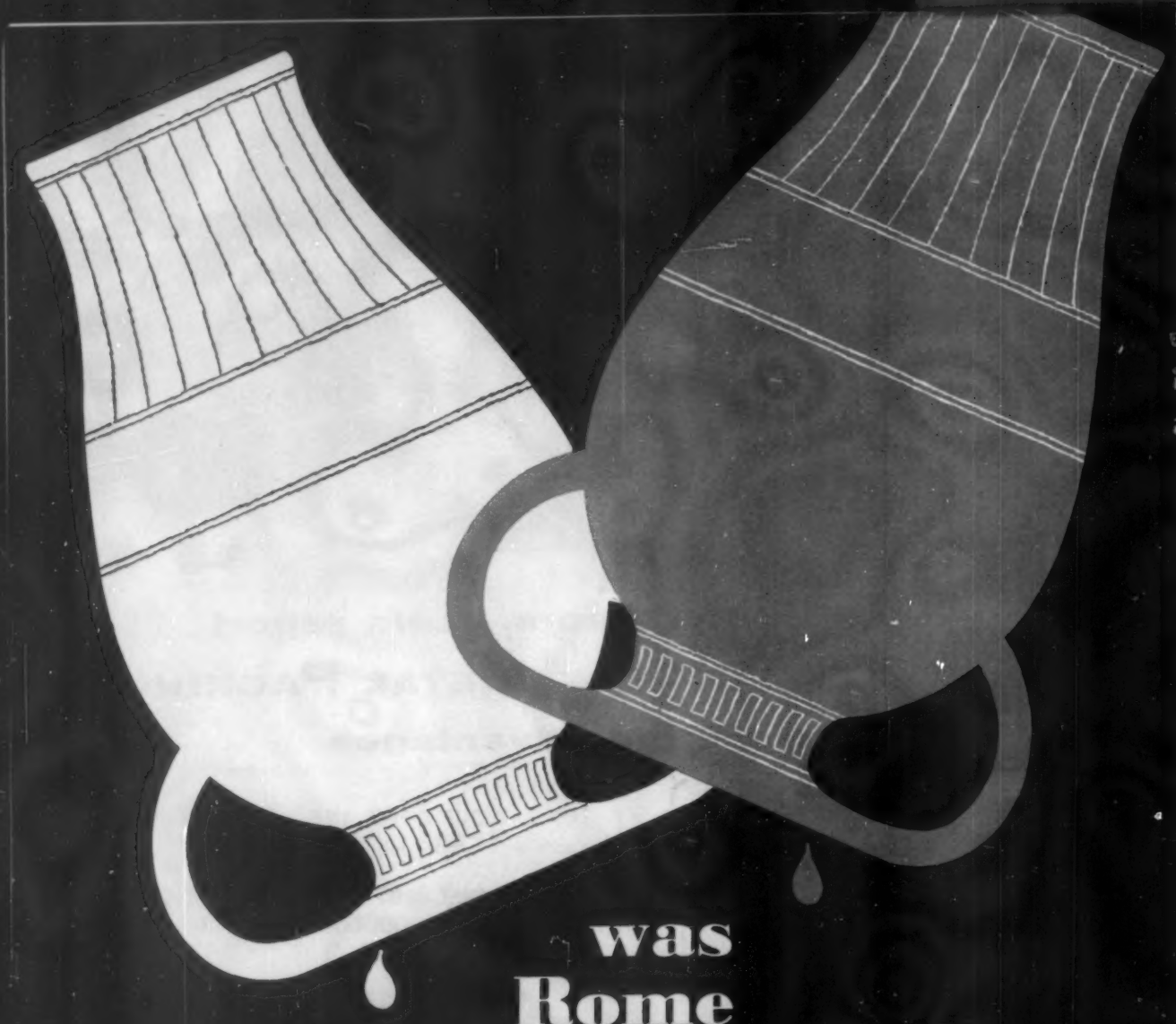
Sales Offices and Warehouses: Baltimore, Birmingham, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Denver, Detroit, Houston, Los Angeles, New Orleans, New York City, Palmyra (N. Y.), Philadelphia, Pittsburgh, Portland (Ore.), Salt Lake City, San Francisco, St. Louis, Seattle, Spokane, Tulsa.

In Canada: The Garlock Packing Company of Canada, Ltd., Toronto, Ont.

GARLOCK

PACKINGS, GASKETS, OIL SEALS
MECHANICAL SEALS
RUBBER EXPANSION JOINTS

For more data circle 582 on Post Card



was Rome burned *up!*

Not the city, mind you, for this was before the days of the Nero caper, but the people — they wanted water. Summers were getting hotter and Romans were getting thirstier. They needed something to drink — with or without calories. Thus began the construction of Rome's famous aqueducts, one of which, scarred but faithful, served the city for almost nine hundred years!

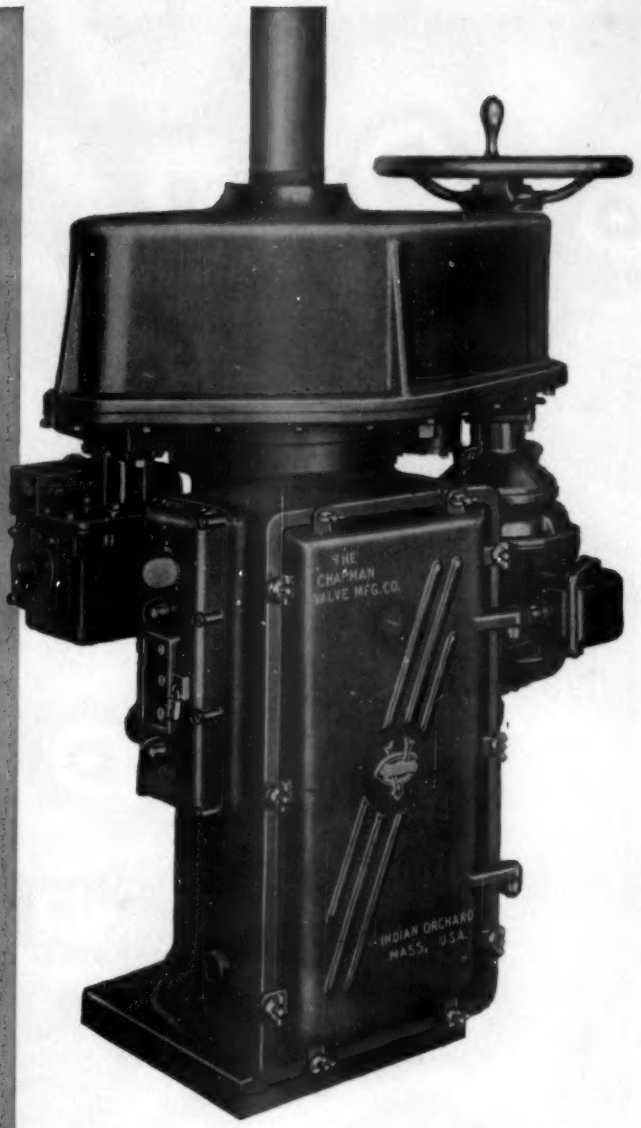
These early aqueduct builders had more to contend with than their thirst. For one thing, they had to carry the ball alone. No skilled specialists or professional consultants stood ready to provide their answers. Today, carrying the ball alone is almost as defunct as the aqueducts themselves. Experienced consulting, design and operating engineers — each contributing his unique skills — cooperate in solving complex water and waste problems that would have amazed the early Romans. Graver believes this interrelation is not only useful but desirable and that all involved can not help but profit by it.

GRAVER

GRAVER
WATER
CONDITIONING
CO.

Fewer Parts Mean Greater Dependability

Floorstand Motor Unit . . . control panel, motor, limit switch and push button station.



Simple, durable mechanism of Chapman's Motor Unit. Handwheel remains stationary during motor operation.

IN CHAPMAN MOTOR UNITS

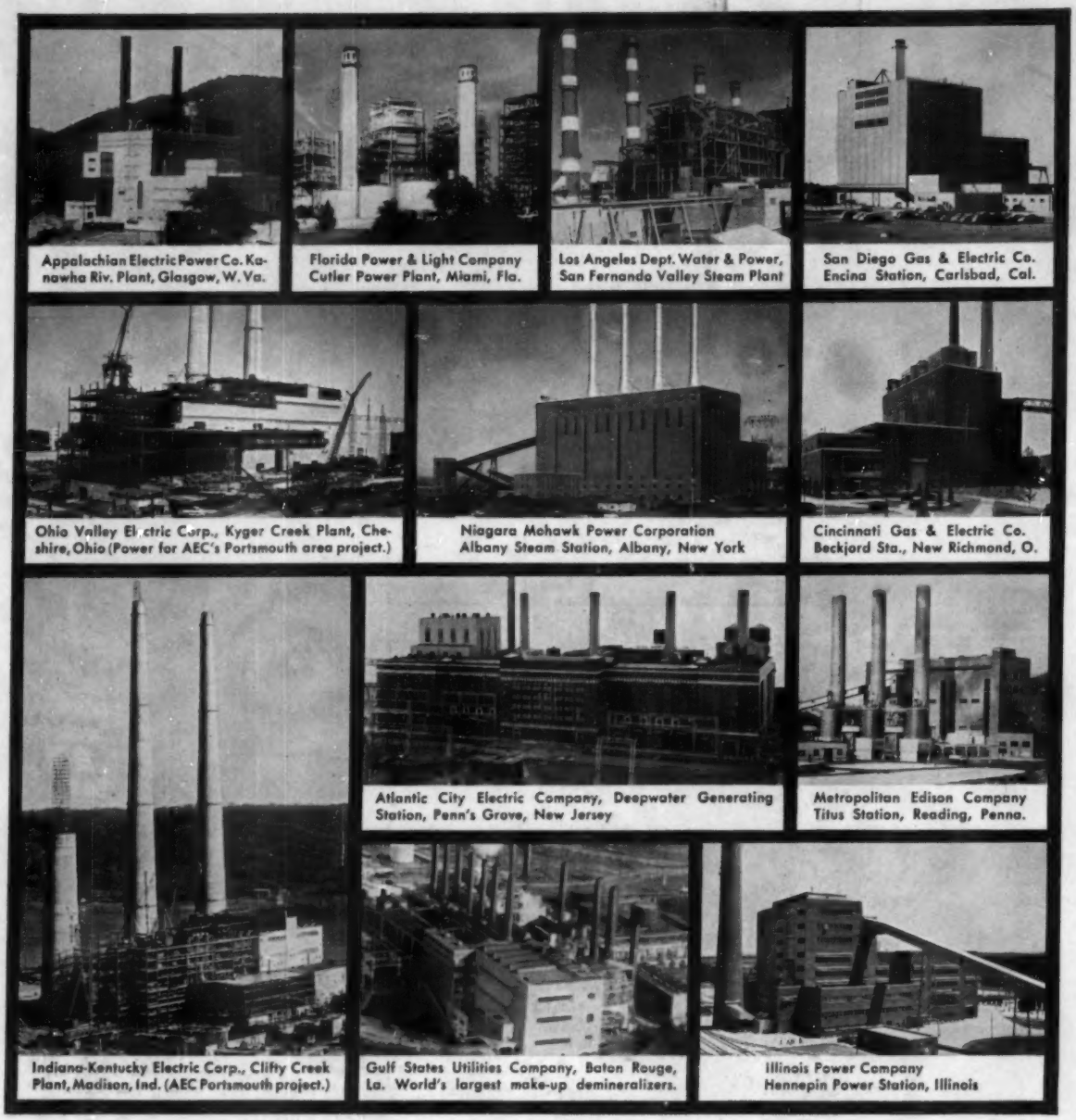
Chapman's simple and rugged Motor Unit gives accurate, trouble-free control of large valves and sluice gates. It has approximately *half as many parts* as any other unit. Its simplified design, low speed motors and low-ratio, stubtooth gears combine to give positive operation without drift, in *any* position and under all conditions.

Installation is fast and simple. The floorstand unit comes completely wired, ready to connect to leads. Limit switch has micrometer adjustment for exact pre-setting for seating tightness. Motor Units operate smoothly under the most adverse conditions. All units are weather-proof and steam-tight. Write today for *new* Catalog 51.

The Chapman Valve Manufacturing Co.

INDIAN ORCHARD, MASSACHUSETTS

For more data circle 584 on Post Card



Appalachian Electric Power Co. Kanawha Riv. Plant, Glasgow, W. Va.

Florida Power & Light Company Cutler Power Plant, Miami, Fla.

Los Angeles Dept. Water & Power, San Fernando Valley Steam Plant

San Diego Gas & Electric Co. Encina Station, Carlsbad, Cal.

Ohio Valley Electric Corp., Kyger Creek Plant, Cheshire, Ohio (Power for AEC's Portsmouth area project.)

Niagara Mohawk Power Corporation Albany Steam Station, Albany, New York

Cincinnati Gas & Electric Co. Beckjord Sta., New Richmond, O.

Indiana-Kentucky Electric Corp., Clifty Creek Plant, Madison, Ind. (AEC Portsmouth project.)

Atlantic City Electric Company, Deepwater Generating Station, Penn's Grove, New Jersey

Metropolitan Edison Company Titus Station, Reading, Penna.

Gulf States Utilities Company, Baton Rouge, La. World's largest make-up demineralizers.

Illinois Power Company Hennepin Power Station, Illinois

Why these power plants chose PERMUTIT® *water conditioning:*

Some chose Permutit for its world-known engineering experience in thousands of utilities and industrial power plants . . . covering every major development in water conditioning from the first zeolite water softeners to the most modern demineralizing systems.

Others chose Permutit for its complete, integrated service: the water-analysis labs, engineering, equipment, controls and ion exchange resins . . . from one source . . . under one responsibility.

But most of the designers of these plants chose Permutit because they have personal knowledge of many installations where Permutit equipment has given long years of efficient, trouble-free performance. They know that's what pays off in the long run.

The Permutit Company, Dept. PE-9, 330 West 42nd St., New York 36, N. Y.

DEMINERALIZERS • ZEOLITE AND HOT PROCESS SOFTENERS • PRECIPITATORS • DEAERATING HEATERS • PRESSURE AND GRAVITY FILTERS • CHEMICAL FEEDERS • AERATORS • BLOW-OFF EQUIPMENT AND OTHER POWER PLANT SPECIALTIES.

For more data circle 585 on Post Card